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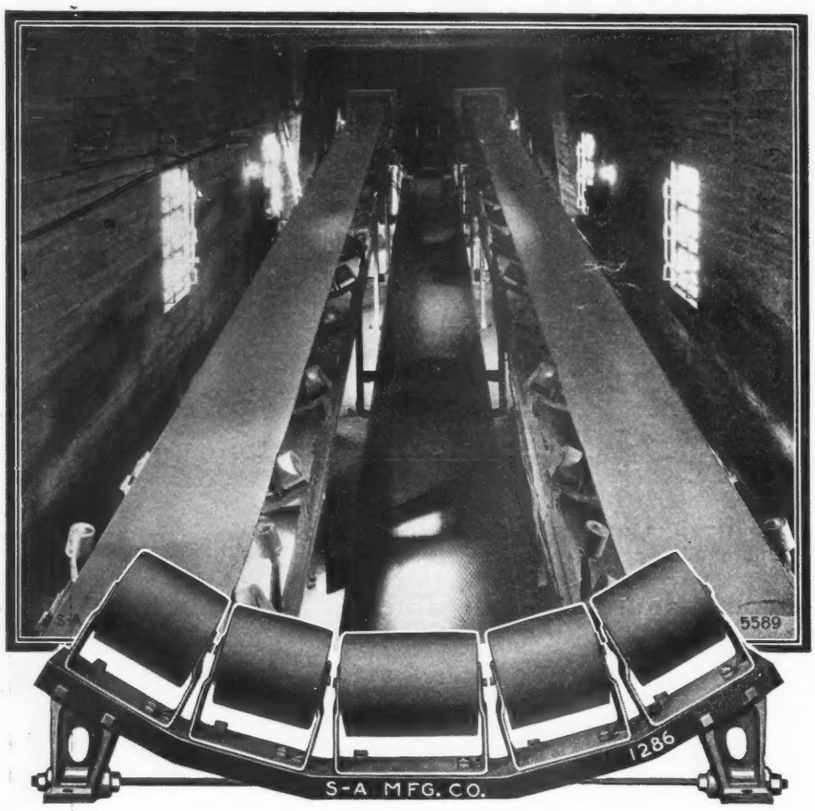
A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

October 21, 1922



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The Automatic Sprinkler in Metal Mines

ONCE MORE there comes before mining men and engineers the unsolved question of how to prevent fires in mine shafts, and when fires have started, how to extinguish them before they spread and get beyond control.

Unfortunately, timber has from the beginning of mining been found especially convenient for the underground support of shafts, stations, galleries, and openings of all descriptions. Its cheapness, convenience, and general usefulness have resulted in this widespread adoption for the purposes noted. Thus there has been introduced in underground mining a relatively large amount of combustible material, which lines the walls of shafts and other workings. Where the timber is dry, there is always a risk of fire, and mine workings are relatively so constricted that accompanying the fire risk there is always the probability of fatalities. The use of brick, stone, concrete, and reinforced concrete obviates the risks created by the presence of combustible material in the adits, working places, and shafts of a mine. Where timber is used it can be made fireproof, or almost so, by keeping it constantly wet, or by coating it with a layer of incombustible material. The only material that has been found suitable for this purpose is gunite. The guniting of shafts, stations, and other timbered openings has been practiced on an extensive scale in the mines at Butte. In our opinion, fireproofing in this manner is a satisfactory, although expensive, method of meeting the problem.

The mine manager can thus, theoretically at least, discard timber entirely or he can use it protected from ignition by a thin layer of incombustible material, such as gunite. Where it is impracticable to do either, on account of prohibitive cost, and where the timber structures are dry, the problem resolves itself into one of adequate fire prevention.

If the miner's co-operation is secured in the observance of wisely selected regulations, drawn up with reference to the particular mine in which they are to be applied, the fire risk is greatly minimized. Too often non-occurrence of fire results in slackness in observing regulations, and the result is a disaster.

Another element lies in the selection of equipment, power cables, and other appurtenances, together with their proper installation and operation. Here again practice has developed and improved apparatus to a point where the fire risk attending its use is small.

Probably the most effective preventive is a well-thought-out and well-applied system of mine inspection. This inspection must be regular and thorough if it is to serve its purpose.

The automatic sprinkler system should be given serious consideration. So far as we know, it is the only appliance that will operate automatically to quench a fire in its initial stages. About ten years ago suggestion was made that this appliance be installed in dry mine shafts that are supported by timber. In the report of the Bureau of Mines Committee on Rules and Regulations for Metal Mines published in Bulletin 75, 1915, the committee said, with respect to the use of automatic sprinklers in mines:

> "In considering the safeguarding of mines against underground fires, the committee directed its attention to the possible introduction of the automatic sprinkling system, which has been so highly successful in reducing the fire loss among industrial plants in the United States, especially in New England. After making some inquiries, the committee felt that it might summarily dismiss the present consideration of automatic sprinklers, for the reason that nothing appears to be known about their application underground. The committee's dismissal of them does not by any means imply a condemnation of them, but means simply the non-existence of data permitting the formulation of any opinion about them. The advantages that they may offer underground and the conditions of their application are well worth experimental investigation."

Frankly, the committee said that it knew nothing about the automatic sprinkler system as applied underground. Mining men, however, have made a somewhat limited use of the system for the protection of shafts underground.

A small fire speedily extinguished by the means suggested would pollute the mine air currents to a comparatively limited extent, and the question of the reversal of the air current by the sprinkling operation would be probably of small moment. With power ventilation there would be no reversal of the air current. The important point is to extinguish the fire in the shortest time. We submit that extended consideration should be given to the automatic sprinkler.

Dividing One's Eggs

THEY TELL the "one-mule" farmer down South that he shouldn't put all of his eggs into one basket; which is another way of advising him not to depend entirely for his income on a crop of cotton. If the cotton market is bad the winter is sure to be hard (not necessarily the weather, but the winter itself). One might suspect that some Tennessean had been preaching this irreproachable advise to Howard I. Young, mine manager for the American Zinc, Lead & Smelting Co., if one were to investigate his diversified activities at Mascot. These include producing excellent crops of alfalfa, corn, tobacco, and vegetables, as well as dairy products sufficient to supply the entire community, which, incidentally, is composed exclusively of mine employees who live in company houses on company land. But it is not only in matters of husbandry that Mr. Young follows the precept of dividing his eggs; he does it in his mining also. The Mascot mine was among the few zinc producers that remained in steady operation, though on a curtailed scale, throughout the post-war depression. Moreover, although the zinc content of the ore averaged less than 4 per cent, the com-

pany was almost able—to borrow a metaphor from the financial scribes—to make a new dollar for an old. This was a consequence, in a large measure, of the practice of shipping, in addition to sphalerite concentrate, the entire bulk of mill tailings to be sold at a good profit.

The jig and other coarse tailings were dried and reground; the principal product was agricultural limestone, although another source of no inconsiderable income was the very fine material, removed in an Emerich separator, which was sold as a filler to the manufacturers of asphalt. There is a big stockpile of unsold zinc concentrate near the mill today, but tailing piles are conspicuous by their absence. Another factor in the excellent result is the unusually low cost of operations. So effectively have mining operations been organized, and so high is the individual efficiency of the miners, that the output per underground shift has been as high as 9.5 tons for a period of several months in succession. Admittedly, the mining conditions are not comparable with those encountered in many districts. However, low wages are not a contributing factor, for miners earn as much as $7 and $8 a day under a novel bonus-contract system of payment; and at the same time per-ton costs have been lower than ever before.

It is true that few metalliferous ores have a gangue of which more than 90 per cent is calcium or magnesium carbonate and which is therefore suitable for agricultural purposes; but no metal-mining company can afford to overlook the possibility (even though remote) of finding a use for the residue from its metal-recovery plant in some of the industries in which non-metallic minerals are used. The marketing of a byproduct may easily mark the difference between failure and success in any mining enterprise. If the miner can get his eggs into two or three baskets, such a catastrophe as the collapse of a metal market may not smash the entire lot and thereby temporarily break him up in business.

Suckers and Vacuum Smelting

NATURE MAY ABHOR A VACUUM; certain mining companies in the southwest and investors elsewhere have learnt, by painful experience, the absurdity of the claims made by the alleged inventor of a vacuum smelting process; but there can be no doubt as to the truth of the adage that a sucker is born every minute. Otherwise it would be difficult to explain how the propaganda in favor of such an idea is being financed, unless the expenditure may be likened to the proverbial sprat that was used to catch the mackerel.

Our readers will remember that the old camp at Ajo, before the Calumet & Arizona company became interested in the district, was the scene of a crude attempt to part the unsophisticated from his roll by means of glowing accounts of the limitless wealth that would accrue to those who gave financial support to the schemes of one Fred. L. McGahan, who had inveigled the Cornelia Copper Co. into selling stock on the strength of promises of amazing metallurgic and economic performance of what was termed a vacuum smelter—a metallurgical absurdity the technical futility of which was exposed by Horace Stevens in the 1906 issue of the Copper Handbook. Since that time we learn that McGahan has been associated with the preliminaries that invariably accompany the introduction of such a scheme, as a bait for the selling of stock, in various parts of North America. Recently the vacuum for suckers has been applied in Texas, although it is to be noted that a slight but not unexpected change in tactics is observable. McGahan does not appear conspicuously as an interested party; propaganda emanates from the office of what is termed the Metal Products Association of Texas. A form letter sent to prospective victims concludes thus: "Read the printed matter enclosed thoroughly—through and through. Catch the enthusiasm of this great moment. Search your conscience—your heart—with prayerful thought. Do what you can. Send $50 anyway. Make it $100, $200, $500—if God has prospered you. Sacrifice with us all. Its a real investment, completes the smelter, starts making you money." The secretary of the association, who apparently compiled this amazing effusion, signs himself, "With faith and confidence, sincerely and earnestly."

A sheet, known as the "Vacuum Smelting News," is also published by the association. In the first number of this, issued only a few months ago, the vice-president of the concern, one Chas. C. Azbell, spotlights a message to the effect that, "1922 is the year of our great success —our final triumph . . . when the vacuum smelting process is to be given permanently to the world, a blessing to humanity . . . " And concludes with the prayer, "May God speed us as we go over the top." Could effrontery go further? In a pamphlet that has also been circulated in Texas, entitled "The Road to Independence," we read that " . . . the McGahan Vacuum Process of Smelting is going to dower the world with a new access of vast, clean, bloodless wealth, and the wealth thus created, instead of going to capitalists or parasites, is going to those who work with hand or brain for an honest living under conditions outlined by Mr. McGahan himself, whose ambition is to see *labor own the products it handles and the wealth it creates* . . . Mr. McGahan, in possession of patents of stupendous financial possibilities, believes the time and conditions ripe for bloodless revolution and change. He proposes that the enormous earnings possible to thousands of McGahan smelters *go to the working classes* under conditions where capital *cannot wrench them away.*"

It passes all understanding that such a claptrap composite of religion, socialism, metallurgy, and philanthropy will serve to collect the small savings of even the most ignorant. It is pathetic to realize that a continual stream of money, of vast amount in the aggregate, needed so badly for legitimate mining investment, steadily passes into the coffers of promoters such as those whose propensities for applying the vacuum to the pockets of the unwary are camouflaged under the title of the Metal Products Association of Texas.

Good and Bad Taste in Metals

NOWADAYS, manual workmen overlook nothing in their search for a reason to go on strike. Recently a force of lathers employed on a building under construction on Long Island struck because they did not like the taste of the nails they were given to use. These men made a practice of holding in their mouths a temporary supply of the nails that they were using, and in their complaint stated that the nails seemed to have been treated with some sort of acid that very quickly caused inflammation of the mouth. This reminds us of the familiar unpleasant effect produced by placing a small piece of copper above the tongue, a piece of zinc under the tongue, and bringing the projecting ends of the two strips into contact.

Shortage of Skilled Miners

REPORTS OF A SHORTAGE of skilled miners come from many mining centers. Apparently this shortage is likely to develop into a real difficulty when large mines attempt materially to increase their tonnage. "Where have all the old-time, all-round miners gone?" is a question that has been asked of us several times in the last month. We do not profess to know. We presume that the labor ranks of the mines have been sapped by other industrial activities. One mine manager suggests that the country garages have absorbed miners who may have had some mechanical skill. Possibly this accounts for some of the difficulties that every traveler experiences in attempting to have repairs made at these same country garages. In a small town recently all of the garage mechanics and blacksmiths were called in to diagnose a badly acting carburetor of the automobile in which we were riding, but in spite of numbers the carburetor continued to assert its independence and almost succeeded in putting the engine out of business. Our driver said that no one in town understood that carburetor.

Almost any nimble-handed man could assist in manufacturing automobile parts and with modest training could assemble with intelligence and skill the finished product. The attractive wages offered are no doubt an incentive to the man who wants to better his condition. Intensive road construction in many western states is another industry that has doubtless added to the difficulty. In a few words, higher wages and better working conditions are the causes of the general exodus of the more ambitious workers from the mining industry. The mines will have to counter with higher wages and materially bettering working and living conditions. As a corollary, this means higher prices for metals, as the efficiency or productivity of the worker cannot be expected to increase proportionally with the increase in wages.

We can also see that it will be necessary for the large mines to undertake the systematic training of the residual labor that they now have. Without this systematic training, the productivity of the individual miner will be out of control. With systematic training it will be possible to insure such a return from the gross outgo that the cost of putting the mine product on the markets of the world will leave a reasonable margin of profit. It is not enough for several large mines to attempt systematic training of miners; every mine should join in the effort to elevate the general scale of labor skill. We suggest that the development of a well co-ordinated scheme of systematic training of mine labor by the large mine operators could be carried out by the American Mining Congress better than by any other agency.

Anticlines and Declines

INFORMATION concerning the oil game, especially on the point of the effect of "anticlines and declines," was recently sought by a Kentucky citizen from a federal bureau. Those to whom he appealed were inclined to think that he was wiser than he pretended. The anticlinal theory of oil accumulation has long been as popular as the secondary enrichment theory of ore deposition. The declinal theory of oil production has not been so enthusiastically embraced, and the well-known genius of the American people has been cited as refutation.

THE JOURNAL-PRESS STAFF

ROBERT MURRAY HAIG

SO BROAD is the field covered by *Engineering and Mining Journal-Press*, that its editorial service frequently demands scientific and authoritative explication and data upon general economic conditions and upon the underlying principles and application of the many forms of taxation that are important factors in the development and progress of the great and basic mining industry. In conformity with the paper's policy of filling every editorial post with the highest type of

ROBERT MURRAY HAIG

specialist available, Robert Murray Haig, Professor of Economics, Columbia University, has since 1920 been Consulting Editor upon those subjects in which he has achieved a national reputation.

Professor Haig was born in Columbus, Ohio, in 1887. He was graduated from Central High School, Columbus, in 1904; graduated, A. B., with special honors in economics, Ohio Wesleyan, in 1908; M. A. in economics, University of Illinois, in 1909, with scholarship in economics; was Research Assistant to Prof. David Kinley, University of Illinois, 1909-1911; was the Garth Fellow in Scholarship in Economics, Columbia University, 1911-1912; has received his Ph.D., Columbia, and has been a member of the Columbia teaching force since 1912.

The services as special counselor and advisor which Professor Haig has rendered to cities and states and to the nation, if set forth here, would fill a column of the *Journal-Press*, and a list of his technical publications on economics and taxation, another. His recent attainment of a full professorship at Columbia confirms the wide recognition of the eminent position as a publicist and authority on economics and taxation that Professor Haig's public and professional work has won for him.

The Tellurides—I

By T. A. Rickard

REFERENCES to this group of minerals are frequent in the mining news, but usually the manner in which they are mentioned is such as to indicate ignorance concerning their composition and character. The first determination of the tellurides was made by Klaproth, who, in 1798, recognized them in the gold ores of Zalathna, in Transylvania, which was then a Hungarian province. Tellurium is a non-metallic element, closely allied to selenium; in their chemical combinations tellurium and selenium act in a manner analogous to sulphur, which separately they appear at times to replace. Native tellurium is a tin-white brittle substance with a bright metallic luster. Its commercial value has been quoted as high as $3.50 per ounce, but the demand for it in the arts is slight, so that a few shipments soon demoralize the market. During the War an effort was made to discover new uses for tellurium, and the Government chemists cooperated with the refiners to this end, but no important chemical applications were developed. It is used for coloring porcelain and glass, as an ingredient of high-resistance alloys, for staining silver, in medicaments, and in the manufacture of sundry special dyes. It is produced in considerable quantity as a constituent of the anode slime in electrolytic copper refining, especially in the refining of copper from the ores of Butte, Montana. As much as 1.174% has been found in the slime at the bottom of the electrolytic cell. The copper refineries can supply 125,000 lb. of tellurium per annum, and even larger quantities could be produced if there were a market for it. Recent research has shown that the use of di-ethyl telluride with petrol increases the efficiency of motor engines, and if this 'discovery' should hold good it may happen that tellurium will gain a high commercial value at last.

Native tellurium is comparatively rare except in Boulder county, Colorado, where it occurs in association with the tellurides of gold and silver. A mass weighing 25 pounds was found in 1877 in the John Jay mine, near Jimtown, in Boulder county. In 1902 I found specimens of it in the Vulcan mine (in Gunnison county, Colorado) in a lode of gold-bearing pyrite, which, in the oxidized zone, included masses of native sulphur, the ignition of which caused much trouble.

Tellurium forms compounds with various metals—gold, silver, lead, copper, bismuth, nickel, and mercury. All these tellurides are distinguished by their brilliant luster. Their importance as minerals of gold and silver was greatly enhanced by the discoveries at Cripple Creek (Colorado) in 1892 and at Kalgoorlie (Western Australia) in 1895. They had been mined in Transylvania for nearly a century earlier, and since 1872 they have been recognized as important ores of the precious metals in Colorado, notably in Boulder county and the La Plata mountains. Another district characterized by them is the northern part of Shasta county, California. Indeed, the tellurides are far more widely distributed than was supposed when the Cripple Creek boom attracted attention to them in this country; they have been found all over the world, usually as an associate of gold. The presence of these beautiful minerals is claimed sometimes in order to give a touch of verisimilitude to the unconvincing tale of an irresponsible promoter. For example, the town of Telluride, in southwestern Colorado, was named at a time when no telluric minerals had been found in that locality. Many years later Mr. Richard Pearce detected traces of tellurium in the concentrate from the Pandora mill of the Smuggler-Union Mining Co. In this part of Colorado, as in other parts of the world, the tellurides are found in association with eruptive rocks, particularly the andesites. However, the wall-rocks of the veins and lodes in which they are mined include the metamorphic series and are so various that it would be unwise to hug any generalization. In California they are found in schist; in British Columbia in black slate.

The first find of a telluride in California was recorded by William P. Blake in 1857; it was a silver telluride, probably hessite, that was washed out of the gravel near Georgetown, in Eldorado county. In 1865 C. A. Stetefeldt described the occurrence of the tellurides of silver and lead at the Melones mine, in Calaveras county, California. Such well-known Californian mining centers as Angels Camp and Grass Valley have contributed specimens of the tellurides.

In Colorado they have won great economic importance. The first discovery was made in 1872 in the Red Cloud mine, in Boulder county, and a paper on the subject was read by Anton Eilers before the American Institute of Mining Engineers in October of that year. In that paper it is stated that "when pieces of the 'float' from this vein were first brought to the Denver branch mint for assay, the enormous figures per ton obtained for the contents of gold and silver almost staggered the assayers", because no native gold or silver, or recognizable mineral containing them, was visible in the ore. The telluride was petzite. The mines of Boulder county were not rich enough to win world-wide fame, but Cripple Creek brought the tellurides before the footlights of publicity and aroused the interest of the prospector all over the United States. That was twenty years after the first finding of a telluride mineral in Boulder county.

In Montana, the first discovery was made in 1867, by J. L. Kleinschmidt, who found tetradymite, the telluride of bismuth, in association with placer gold, which had been derived from the erosion of the Uncle Sam lode. In 1885 Richard Pearce detected a telluride of lead in gold-bearing pyrite at Bannack. Later the telluride of gold was found in association with fluorite and phonolite, as at Cripple Creek, in the Judith mountains, in Montana. Again, the gold ore of the quartzite in the Black Hills of South Dakota owed its reputation for refractoriness to the occurrence of the gold as a telluride.

In Utah similarly the ores of the Mercur district were rendered refractory by the presence of the gold as a telluride, necessitating special care in roasting. The most celebrated telluride district, however, is not in the United States but in Western Australia. Kalgoorlie became famous in 1896 and 1897, when a series of extremely rich mines were opened up on the Great Boulder vein and on others belonging to the same lode system. The association of highly profitable mining with the occurrence of tellurides had the effect of bringing these minerals into economic prominence, and it had the equally natural effect of generating sundry fallacies. These I shall discuss in my next article.

DISCUSSION

In Further Defense of the Prospector

THE EDITOR:

Sir—I read the article appearing in your columns of Sept. 2 entitled "What Is the Matter With Mining?" A perusal of the criticisms of the Mexico correspondent will convince the initiated that he made a snapshot attempt at covering a big subject in a hurry, without impartial consideration to all sides of the question. I agree with the gentleman's opinion upon some of the stated cause and effect, but as to his sentiments toward the prospector I must take issue with him. He states that the prospector is no longer an essential factor in the future of the mining industry, and that he should be compelled to pay prohibitive taxes to possess a claim; consequently he would be compelled to forfeit the fruits of his labor and experience to others more financially fortunate.

If there is anything wrong with the mining business, I want to state right here that the expression of such sentiments is not going to help matters much. Why all the worry and fuss about the prospector and the mining laws of the United States? Our mining laws are all right, with the possible exception of the extralateral or apex clause, which could be repealed by an act of Congress of twenty words.

Why desire to inflict prohibitive taxation upon the already burdened poor prospector, whose greatest visible assets are his experience and courage? Why not include all lands that are being monopolized for speculative purposes by applying a tax rate based upon what would be an accepted sale price by the owner?

The few claims and fractions that are being held by the prospectors of the country are comparatively only a drop in the rain barrel when compared to the vast areas of coal, iron, timber, petroleum, and agricultural lands that are being monopolized for strictly the same purpose that the prospector is hoping for—money, profit, the dollar! So it is quite unwarranted to centralize all the target practice upon the prospector! The prospector varies in intelligence and character as other men do in all walks of life. You will find some of his vocation quite alive to the scientific facts of the industry, and keeping pace with the progress of the times. Give this type of prospector a little co-operation by making it possible for him to exist, and he will continue to find mines henceforth, as he has always done in the past, right here in the United States.

I have no bone to pick with the legitimate mining geologist, but I do feel justified in criticising a certain variety of self-styled mining engineer with whom I have frequently come in contact, as this species of engineeer seems to possess an over-worked tendency to try to make every prospect conform to a familiar type, or else turn it down as a safeguard to what he religiously believes to be his professional future.

I might add, as a suggestion to this type of mining expert, that if he would endure conversation with certain prospectors that I happen to know, he might learn something to his advantage which he had heretofore overlooked.

The investor should become more intimately acquainted with the prospector, so that he may be capable of selecting him from among the upstart camouflaging would-be mining experts, who announce themselves as being and having just the thing you may be looking for.

There are still to be found reasonably intelligent owners of gold, silver, and rare mineral prospects of outstanding merit who are eagerly awaiting the approach of the legitimate investor who will go fifty-fifty with them upon a square-deal development basis.

So here is hoping that the real prospector will long be a welcomed citizen among the honorable members of the mining business.

V. A. TAMNEY.

Reno, Nev.

Ferric Salts as Solvents in the Leaching of Roasted Copper Ores

THE EDITOR:

Sir—In your issue of Sept. 9, 1922, Percy R. Middleton reviewed the question of "Ferric Salts as Solvents in the Leaching of Roasted Copper Ores" and presented some meritorious suggestions on proper equipment in which to carry out such leaching work on a commercial scale. However, we wish to raise objections to two points which he makes. On page 451 he mentions the reaction between a solution of ferrous sulphate and solid cupric oxide (ignoring water of hydration) as being expressed as follows:

$$CuO + FeSO_4 = FeO + CuSO_4.$$

We are unable to believe that such a reaction takes place to any appreciable extent unless one of the reaction products, either ferrous oxide or cupric sulphate, is continuously removed during the progress of the reaction. Ferrous oxide is known to be a stronger base than cupric oxide, and, in fact, the data proving this can be found in the recent work done by many investigators by the help of the hydrogen electrode in the determination of the hydrogen ion concentration of all manner of solutions. Cupric hydroxide does not form from solutions until their hydrogen ion concentration has been lowered to about 10^{-7} gm. per liter, whereas ferrous hydroxide will not form from solutions until the hydrogen ion concentration has been lowered to about 10^{-5}, an acidity which is nearly one-hundredth that at which cupric hydroxide begins to precipitate. Pure water has a hydrogen ion concentration of 10^{-7} under the same conditions, so a suspension of ferrous hydroxide, because it contains fewer hydrogen ions than water, is basic or alkaline. Therefore, if there is any chemical reaction it should take place in just the opposite direction to that indicated by Mr. Middleton. These figures are for ordinary room temperatures.

To be strictly accurate, it is probable that Mr. Middleton's reaction should be written as a reversible one which comes to equilibrium with nearly 100 per cent of

the products represented by the left-hand side of the equation, and only a minute amount of ferrous hydroxide on the right-hand side of the equation in equilibrium with it. If this small amount of $Fe(OH)_2$ were to be oxidized by dissolved air or any other source of oxygen, it will form ferric hydroxide, which will precipitate at all concentrations of hydrogen ions under 10^{-2} to 10^{-4} (indefinite due to formation of basic salts). This would remove ferrous hydroxide effectively from the zone of reaction, and the reaction could then, and not until then, approach completion in the direction that Mr. Middleton has written it. This latter combination of reactions is utilized in the purification of copper-sulphate solutions in some of the older copper refineries.

On page 452 Mr. Middleton mentions the oxidation of ferrous-sulphate solutions according to the following reaction:

$$4\ FeSO_4 + O_2 = Fe_2(SO_4)_2 + Fe_2O_3 \cdot SO_3.$$

In other words, about 50 per cent of the iron forms basic ferric sulphate, which is insoluble and precipitates. It is therefore not available for leaching. To obviate this difficulty he states that the solution can be made acid before oxidation, and then the reaction is

$$2\ FeSO_4 + H_2SO_4 + O = Fe_2(SO_4)_2 + H_2O.$$

Middleton maintains that oxidation is effected in his experimentation by blowing the solution with hot air in a tank fitted with false bottoms of porous brick. We are unable to understand how Mr. Middleton is able to carry on effective oxidation of ferrous sulphate in an acidified solution, using either hot or cold air as the oxidizer. To be true, such oxidation takes place slowly, often to the exasperation of the analytical chemist whose solutions slowly spoil as they stand in bottles on the shelf, but for all commercial purposes ordinary oxidation by air, either hot or cold, is too slow and incomplete. In alkaline solution the oxidation takes place readily, but that is not the subject of the present debate. This is the result of our own sad experience, as well as that of others. See the work done at Cananea (W. L. Austin, *Mines and Methods*, September, 1910) and by Baskerville and Stevenson (*J.A.C.S.*, Vol. 33, p. 1,104 [1911]). Others have doubtless tried it and will join us in asking for more data on just how Mr. Middleton accomplishes a commercial amount of oxidation of either acid or neutral ferrous sulphate solutions by air.

L. E. ROBERTS,
G. S. TILLEY, and
O. C. RALSTON.

Berkeley, Calif.

Is the Extent of Volatilization of Metals Realized?

THE EDITOR:

Sir—During 1895, when in the north of England, I had occasion to take a sample of flue dust from the dust catcher of a blast-furnace plant running on Spanish ores. An analysis gave $15 worth of gold per ton. To this I gave little attention, thinking it to be merely one of the strange places in which gold might be found. Ten years later I read some statements made by a Mr. Aarons on the losses of precious metals in roasting ores. Mr. Aarons had come to the conclusion that gold was being volatilized in some form which was not easily condensable.

About this time I came into possession of a very slimy ore, basic in character, containing sulphur, arsenic, and carbonate of lime. Precious metals ran about $9 per ton. The ore was so slimy that it was extremely difficult to wash out any soluble chlorides after treatment with aqua regia or chlorine gas. In assaying, I placed silver plates, cooled on the upper surface, in contact, so far as possible, with the fumes coming from the assay furnace. At the end of every fifteen assays I melted the silver, added a little carbonate of soda on top of the melt, and finally broke open the pot. No borax was used, and the button, parted with nitric acid, was finally cupelled in a morganite cupel.

These experiments included: 1, making a plain roast with free access of air; 2, roasting with addition of niter; 3, assaying with niter on account of the arsenic. Using every care to make all heats the same, weighing in each test the same quantity of ore, and keeping each roast separate so far as possible, the buttons obtained from the parting of the silver plates weighed from 3 to as high as 60 mg. of gold. Although these experiments admitted of no definite conclusions as to the gold value of the ore, for it was obviously improbable that the plates condensed the total amount of gold in the fume, they served to indicate that on a $9 ore sufficient loss in the fume was probably occurring to render the assay values extremely doubtful.

Shortly afterward I visited a laboratory in which the chemists had been obtaining results running from $5 to $15 per ton on material from which no other chemists had been able to obtain any such figures. I was one of those who were unable to find anything. Six independent assayers were brought in, using their own fluxes and material, but doing the work in the laboratory furnace. The six results were the same—nothing. Later, an open barrel of flux was tested and, giving a stannous chloride reaction for gold, the proprietors were charged with having deliberately salted the material, and the laboratory went out of business, discredited.

Now, it seemed strange for the proprietors to invite independent chemists in and not to remove any salted flux from the laboratory. I decided to go further into this matter and laid in a stock of the ore, using a new furnace and ample amounts of fluxes, which were in paper bags and small barrels. For two weeks I tried every method of assay, both pot and scorification, with negative results. Then small amounts of gold showed, and after a time the average of gold recovered fluctuated from about $3 to $5 a ton, with a tendency upward. During this time, a small boiler stood in the room. At intervals this was used to generate steam, the water being supplied from a barrel filled from a well outside. A noticeable yellowish substance was accumulating on the inside of the gage glass. Testing the well gave no reactions for any of the precious metals; stannous chloride tests of the barrel water, however, gave undoubted signs of gold. Scrapings from the assay furnace showed only slight colors by the same test. The next tests were made on the fluxing materials, which had remained uncovered. The result was a great surprise. Every chemical not protected and in corked glass bottles was salted with the volatilized metals.

Further researches into the reasons for the volatilization of this particular material, by myself and independent parties, showed no indication of any volatile elements such as sulphur, arsenic, selenium, or tellurium, the ore being highly siliceous, and free from lime or other alkaline constituents. Cooling the ore from a bright red heat, apparent signs of the volatilizing of some substance were noted, commencing at 100 deg. F. Volatilization of metal seemed to be going on, which

impregnated the exposed chemicals with some fine substance.

Differences of opinion between the assayer and his clients as to the assays of ores are well known and are constantly recurring. Charges and counter charges have blown about. Possibly many metallurgists have, like myself, been puzzled by seeing gold in the prospecting pan and not having it show in the assay, even when done by himself.

The tendency in the mining of precious metals has been to take the line of least resistance, to quickly recover the metals, to make large outputs, to install immense engineering equipments. The chemical laboratory (if there is one) of the average mining plant has come to be used for checking up commercial results on established lines rather than for research work on the valuable constituents of an ore.

Much valuable work has been done on volatilization, and much information gained, but is not a great deal of volatilization going on that we know nothing about?

Syracuse, N. Y. EDWIN C. JORDAN.

Recent Developments in Dressing Feldspar

THE EDITOR:

Sir—Having spent nearly a year at Erwin, Tenn., first in the reconstruction of the old dry-grinding plant of the Clinchfield Products Corporation, and then in the development and installation of the wet-grinding and purification processes now used by that company, I have read with interest the article entitled "Recent Developments in Dressing Feldspar" which appeared in your issue of Sept. 30.

Your representative has given an accurate description of the processes in use at the three mills operating about Erwin, but, judging from the last paragraph of the article, he failed to note some of the greatest advantages of the wet process—namely, the saving in power and in dust losses.

The Clinchfield Products Corporation formerly operated three conical mills and two tube mills, requiring a total installed horsepower of 450, for the mills only, when dry grinding. At the present time, with a total of 200 installed horsepower on the grinding mills and using only two out of the five mills, the operators are getting 50 per cent more tonnage out of their wet-grinding plant. Auxiliary machinery used in crushing, drying, conveying and complementary operations is about an even balance between the dry mill and the wet mill.

Labor and repairs in the wet mill are unquestionably less, either in total requirements or per ton, and the workmen are operating under clean and healthy conditions. It may readily be imagined what these conditions were when dry grinding was the practice and the dust losses frequently ran as high as 6 per cent. The saving of this loss alone should nearly meet the entire labor payroll.

One of the biggest advantages of wet grinding has been correctly seen by your representative, in the saving to result from the cost of mining feldspar. Full advantage of this saving cannot be secured, however, until the users of feldspar—in other words, the customers of the grinding mills—are willing to accept without prejudice such feldspar as is offered, regardless of how it is mined or milled, if it meets standard specifications, yet to be adopted. There are many large users who still demand that the spar be crushed only with rock hammers, chaser stones, and silex-lined batch mills.

The American Ceramic Society is making an endeavor to get the feldspar grinders and users to agree to standardize their specifications. When this is done they may reasonably demand a better and more uniform spar and save some of the gray hairs now rapidly covering the heads of the grinders.

It is only a short time ago that I was told the experience of a prominent grinder of flint for the pottery trade, which will be given here as contributing to the above-noted conditions: The flint grinder when visiting one of his largest customers was asked how he ground his product. On his statement that he passed the dry glass sand through a large silex-lined pebble mill, in a small but continuous stream, he was told that the potter wanted no more of his product unless he was prepared to grind it in intermittent batches. It made no difference if the grinder took the same sand, put it in the same pebble mill, and ground it as a batch, dumping the charge when sufficiently fine, just so long as he did not pass it continuously through the mill.

Very little feldspar, as compared to flint or clay, enters into the ceramic industry, and it seems entirely reasonable to conclude that many difficulties attributed to the spar can be justly shared by the clay and flint.

Much of the flint used is prepared by grinding the finer grade of silica sand. This is a product often secured from crushing quartzite by means of rock crushers and Chile mills, afterward washing the sand in cast-iron screw-conveyor types of log washers. The rock crushers, Chile mills, log washers, driers, and much of the conveying equipment are made of iron or steel, and yet one seldom hears any complaint on this score.

Your representative has not touched on the mining of feldspar. When he does, he will have a great deal more to write on that subject than he has so ably set forth on the subject of milling at Erwin.

A majority of the feldspar grinders mine little or no ore of their own, but buy such odd lots of crude spar as can be secured in their district. Spar is mined by individuals or companies almost entirely from surface cuts or quarries, and every endeavor is made to prevent the making of fines—that is, such material as will go through a coke fork. This is seldom accepted by the grinder.

Each lump of spar is actually moved by hand, and such impurities as can be broken off with a cobbing hammer are removed from each piece. The spar is then piled up on the ground, awaiting a purchaser, or moved to the railroad or shipping point as the weather and other conditions permit.

Not infrequently is it necessary to break five tons of rock to secure one ton of clean feldspar. This is the curse of feldspar mining, and to date no attempt has been made to remedy it.

The most obvious thing, the use of a picking belt, has never to my knowledge been employed, and one sees at most of the American spar mines groups of men sitting on the ground, pecking away at chunks of spar with small cobbling hammers and producing, even under favorable conditions, less than one ton of clean spar per man per day. Frequently this hand-cleaned spar is passed over a grizzly or screen after cobbing, in the hope of removing more impurities, and screened again in a like manner when unloaded at the grinding mill.

Is it any wonder that feldspar commands its present price? W. H. LANDERS.

New York City.

The Greenawalt Electrolytic Copper-Extraction Process

Principal Reduction of Ferric Salts Accomplished by Hot Sulphur-Dioxide Gas in Special Reducers That Afford Ample Time for Reaction — Copper Sulphide, Obtained by Hydrogen-Sulphide Precipitation of Lean Solutions, Also Used

By William E. Greenawalt

THE EXTRACTION OF COPPER from its ores by wet methods is one of the most promising fields in modern metallurgy. With acid leaching, it is generally conceded that the vital problem is the precipitation of the copper from the leach solutions, and that electrolytic precipitation offers the greatest advantages. Electrolytic precipitation, however, presents certain difficulties. The most serious of these is due to the presence of iron, which is inevitably dissolved with the copper by acid. Ferrous sulphate in the electrolyte is not particularly harmful, but ferric sulphate is highly detrimental. If a solution of copper sulphate containing ferrous sulphate is electrolyzed, copper is deposited at the cathode while sulphuric acid and ferric sulphate are produced at the anode. The ferric sulphate so produced recombines with the deposited copper, and is again reduced to the ferrous condition. The loss of efficiency due to this cause is more or less proportional to the amount of ferric sulphate in the electrolyte, or copper solution, and under certain conditions may be quite large.

As little as 0.5 per cent of ferric iron in the electrolyte makes the deposition of the copper highly inefficient, and 0.75 per cent is sure to make it unprofitable. In aggravated cases the loss of efficiency due to the ferric iron may be so great that the copper is redissolved as rapidly as it is deposited.

The problem of the electrolytic deposition of copper from leach solutions practically resolves itself into the reduction of the ferric salts, and maintaining the ferric salts in the electrolyte at a certain low maximum—say about 0.25 per cent ferric iron, for good work. This is what is accomplished by the Greenawalt process, in addition to meeting the minor difficulties which arise in copper leaching and electrolysis. Precipitation by iron has been widely used in copper leaching. With iron precipitation, however, both the acid and the iron are irrecoverably lost, and the resulting cement copper has practically no greater value than a high-grade concentrate. With electrolytic processes, where an abundance of sulphide ore or concentrate is available for sulphur-dioxide reduction, 3.0 lb. of acid can be regenerated per pound of copper deposited. The process can be made self-sustaining in acid on sulphide ores, and nearly or entirely so on many oxidized ores.

It is well known that two of the largest copper companies are now treating their ores exclusively by leaching and electrolysis, and that they are probably producing copper at the lowest cost; nevertheless, it is reasonably certain that the methods used are not generally applicable without radical improvements, especially as applied to the treatment of copper ores or concentrates containing a high percentage of iron. Yet the iron may prove, in time, to be a decided benefit.

Various methods have been proposed to overcome the deleterious effects of ferric salts in the electrolyte. They may be briefly summarized as follows:

1. By interposing a diaphragm between the electrodes so as to prevent the ferric salts formed at the anode from getting to the cathode.
2. By chemically precipitating the iron out of the solution before electrolysis.
3. By diverting a portion of the copper solution at each cycle so as to maintain the iron salts at as small a percentage as possible, and precipitating the diverted portion chemically, usually with scrap iron.
4. By rendering the ferric salts harmless, or perhaps even useful, by effectively reducing them to the ferrous condition.

The first of these methods has been tried repeatedly, but the complications arising from the use of a great number of diaphragms, their lack of endurance, and the increased power made necessary by their adoption, have not given this method of attacking the problem a hopeful outlook.

The second method involves serious complications. Iron is not easily precipitated from acid solutions, and if the solutions are made neutral, copper is also likely to be precipitated with the iron. If the iron is precipitated in the early stages of the leaching when the solutions are made neutral, much of it is certain to be redissolved in the later stages of the leaching.

The third method is applicable, especially with reasonably pure copper ores where not much iron goes into solution. A great deal of acid is wasted, and the process must be supplemented with extensive chemical precipitation, so that much of the copper produced is the impure cement metal, and this represents a loss of iron and a loss of acid. The cement copper so produced must be smelted and refined as a separate process.

The fourth method offers a thorough solution of the difficulty provided the reduction of the ferric salts can be successfully accomplished. To effect this reduction, sulphur dioxide, produced either from burning sulphur or from roasting sulphide ores, has generally been used, but has not given the results sought.

It is generally conceded that if a thorough reduction of the ferric salts can be effected, a current efficiency can be obtained with foul solutions closely approximating that obtainable with pure solutions, and that the energy efficiency with a solution containing a fairly high percentage of ferrous iron may considerably exceed that with pure solutions. It is essentially a matter of maintaining the iron reduced to the ferrous condition, so that the ferric iron in the electrolyte will not exceed a certain small percentage—say from 0.10 to 0.25 per cent. The rate of the disintegration of the anodes is also greatly reduced by carrying a high percentage of ferrous iron in the electrolyte.

Sulphur-Dioxide Reduction

The Greenawalt process consists, essentially, in the effective reduction of the ferric salts formed by the electrolysis, by (1) sulphur dioxide; (2) copper sulphide, and (3) by a combination of (1) and (2). In the development of the Greenawalt process it was early discovered that sulphur dioxide, as ordinarily applied, was not an effective reducing agent for the ferric salts. Three important factors enter into the operation—time, temperature, and acidity of the solution.

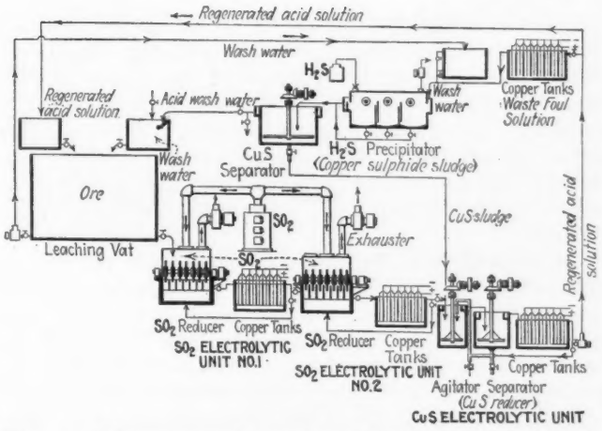

Fig. 1.—Diagrammatic section showing the flow in the Greenawalt process

In the usual application of sulphur dioxide both time and temperature are ordinarily reduced to a minimum, and no attempt is made to reduce the ferric salts in highly acid solutions. It takes only a few minutes for solutions to pass through scrubbing towers against an ascending current of sulphur dioxide, and even if there are several towers in series, the time is still much too short for effective reduction. The reduction of the ferric salts is quite slow, especially in acid solutions and at ordinary temperatures, and it should be remembered that acid is continuously regenerated with the deposition of the copper.

In the early stages of the development of the Greenawalt process, it was sought to remedy this condition by having a large storage tank under the scrubbing tower, and repeatedly passing the solution through the scrubbing tower against an ascending current of sulphur dioxide. This improved matters, but it was still found that the gas absorbed by the copper solution was soon exhausted, especially if the copper solution was maintained at a fairly high temperature, and it was at the higher temperatures that the application of the gas to the copper solution was most effective.

Elaborate experiments were also made in applying the sulphur dioxide direct to the electrolyte in the cells, or copper-depositing tanks, but even when the electrolyte was maintained saturated with the gas, the ferric salts rapidly increased. Clearly, the time element was lacking.

The next step was to discard the scrubbing tower entirely and maintain a large pool of the copper electrolyte under continuous treatment with sulphur dioxide, and to circulate the electrolyte between the reducer, or pool, and the cells, so that the electrolyte from the reducers will be almost completely reduced. This can be done by proportioning the size of the pool and the rate of flow.

The general arrangement for the commercial operation of a Greenawalt plant comprises a series of sulphur-dioxide reducers, a series of groups of copper-depositing cells, and a flow of solution arranged so that there is a regulated stream of reduced solution from the reducers to the corresponding cells, and of electrolyzed solution from the cells to the corresponding reducers, in a sort of closed circuit, while at the same time there is a regular advance flow of a portion of the solution through the entire series of reducers and cells. The electrolyzed solution, depleted in copper and regenerated in acid, is then returned to the ore to pass through another complete cycle of leaching and electrolysis.

Under these conditions of operation it has been found practicable to deposit 1.4 lb. of copper per kw.-hr., with lead anodes, measuring the voltage across the busbars of the copper-depositing tanks or cells. This would indicate from 1.0 to 1.1 lb. of copper per kw.-hr. at the a.c. switchboard, and this is about 50 per cent better efficiency than is at present realized in operating plants. Carefully conducted tests show results which may be summarized as follows:

Total iron in the electrolyte, per cent	3.06
Copper in solution at beginning, per cent	3.89
Copper in solution at end, per cent	1.04
Per cent copper removed	2.84
Copper removed, percentage of total	73.3
Acid in copper solution at beginning, per cent	1.72
Acid in solution at end, per cent	10.30
Lb. copper deposited, per 1,000 amp.-hr.	2.4
Lb. acid produced per lb. copper deposited	3.17
Lb. copper deposited per kw.-hr.; d.c. at cells	1.38

These results are significant. The increased current efficiency, though important, is a secondary matter. The real significance lies in the fact that under the conditions of this process it is quite practicable to treat concentrates or high-grade copper ores. The treatment of such material is not practicable where only a small amount of the copper—say 15 per cent of the total—is deposited out of the solutions and where only a correspondingly small amount of acid is regenerated before the solution is returned to the ore. Where, say, 1.0 per cent of acid is regenerated in the deposition of the copper, a leaching problem of some magnitude would be presented in the treatment of a 15 per cent copper concentrate high in iron.

General Arrangement of Greenawalt Process

A general idea of the process may be obtained from Fig. 1. Fig. 2 depicts the sulphur-dioxide reducers. These reducers, it is believed, present a decided advantage over scrubbing towers, aside from any chemical considerations. Scrubbing towers are likely to become clogged by the hot roasting-furnace dust and gas, and it is not easy to get a uniform distribution of the gas. With the Greenawalt reducers, nothing of that sort can occur, no matter how hot the furnace gas is or how much dust it contains. The gas from the roasting furnace is simply sucked through the reducers, over the pools of copper solution, and the copper solution is continuously sprayed into the gas. The cleaning of the reducers is a simple matter, but there is no reason why they should ever require any special cleaning. The electrolyte is at all times saturated with the gas, and both the sulphur dioxide and the heat from the roasting furnace are absorbed by the solution. This hastens the reducing reaction, and the higher temperature of the electrolyte has a tendency to lower correspondingly the voltage of deposition, and consequently the power consumption. It would also increase the action of the ferric sulphate to re-dissolve the deposited copper, if allowed to accumulate, but, as already indicated, the ferric salt is not allowed to accumulate. The mechani-

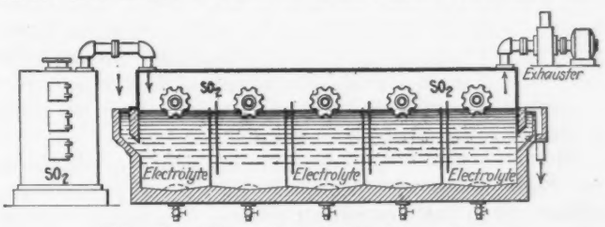

Fig. 2.—The sulphur-dioxide reducer

cal operation of the reducers does not present the slightest difficulty. The solution may also be maintained, with advantage, at a fairly high temperature, as the solubility of the gas in the solution is of no great consequence in this way of applying the sulphur dioxide.

Another leaching problem of some magnitude would be presented in treating a 15 per cent copper concentrate by the ordinary methods, if the issuing leach solution contained, say, 3.0 per cent total iron and 3.0 per cent copper, if only 0.5 per cent of the copper were removed by electrolysis before the ferric iron reached a prohibitive limit, so that the solution would be returned to the ore containing 3.0 per cent of iron and 2.5 per cent of copper. Such a leach solution would not be an effective solvent for copper from ores. The more nearly a solution becomes saturated with copper, the less active it becomes in dissolving more copper.

Chemical Precipitation of Copper Largely Obviated by Proposed Method

In the treatment of a high-iron copper ore or concentrate the iron in the copper solution would accumulate so rapidly that, by the usual methods of reduction and electrolysis, a large proportion of the copper would have to be precipitated chemically. In treating highly siliceous ores, about 25 per cent of the copper is precipitated chemically, and in the treatment of high-iron copper ore or concentrate, this percentage would be so greatly increased as to present a serious difficulty. By the Greenawalt process of sulphur-dioxide reduction, on the contrary, no difficulty would be encountered, for the reason that the amount of copper requiring chemical precipitation, in any case, would not exceed 5 per cent of the total.

This application of the sulphur dioxide will result in a greatly increased ampere efficiency in the deposition of the copper, a reduction of the voltage, a more effective regeneration of the acid and utilization of the sulphur gas, prolonged life of the anodes, and simplifying of the leaching of the copper from the ore, for the reason that the returned solutions will contain less copper and more acid and the volume of solution to dissolve the copper from the ore will be greatly diminished. Then, too, a much higher percentage of iron may be in the solutions and in the electrolyte than is otherwise possible. It must be evident that a high-iron and low-copper solution will dissolve more copper and less iron from the ore than a high-copper and low-iron solution, and this is an important factor in the leaching of copper ores.

Copper-Sulphide Reduction

In the treatment of copper ores by sulphuric-acid leaching, electrolytic deposition of the copper, and sulphur-dioxide reduction of the ferric salts, two difficulties are encountered. First, the solubility of sulphur dioxide is considerably less in acid than in neutral solutions, and the reduction of ferric salts in the acid solution, in the later stages of the copper deposition, is more difficult than in the early stages. Second, large amounts of copper have to be chemically precipitated from the lean and foul solutions, and this chemically precipitated copper is in an undesirable form as compared with the electrolytic metal.

The Greenawalt process makes adequate provision for both of these difficulties. In the sulphur-dioxide reduction, in the Greenawalt process, the acidity of the solution within practicable limits is not a serious matter, as the necessary time and temperature are provided for complete reduction under all ordinary conditions. Nevertheless, in the later stages of the copper deposition, it will usually be desirable to use a more energetic reducing agent than sulphur dioxide. This reducing agent is found in concentrated copper sulphide, especially the precipitate obtained from precipitating the copper from the lean and foul solutions with hydrogen sulphide.

At present it is the universal custom to precipitate the copper from the lean and foul solutions with scrap iron. This necessitates the precipitation of fairly rich discarded solutions from the electrolytic plant. If the copper in the foul solutions is precipitated closely by electrolysis, the electrolyzed solution will be correspondingly high in acid. Both the acid and the ferric salts have to be neutralized at the expense of the metallic iron before the copper in the solution is adequately precipitated. This is clearly shown from the data given for the New Cornelia Copper Co. at Ajo, Ariz., for the iron precipitation of the discarded electrolyzed solutions. (Tobelmann and Potter, *Trans.* A. I. M. E., February, 1919.)

SOLUTIONS ENTERING AND LEAVING THE CEMENTATION PLANT, NEW CORNELIA

	H_2SO_4, Per Cent	Copper, Per Cent	Ferrous Iron, Per Cent	Ferric Iron, Per Cent	Specific Gravity
Entering	2.34	2.12	1.07	1.44	1.31
Leaving	0.08	0.02	4.54	0.08	1.25

It will be seen, therefore, that both the acid and the ferric iron are practically neutralized at the expense of the metallic iron for precipitation, and to attempt to deposit the copper closer electrolytically, under these conditions, would simply mean a waste of power, a waste of acid, and a waste of iron.

In the Greenawalt process the copper is precipitated from the lean and extremely foul solutions with hydrogen sulphide, and the copper sulphide so obtained is then applied to the electrolyte to reduce the ferric salts formed by the electrolysis, in the later stages of the deposition of the copper. As it is desirable to precipitate the copper from acid solutions by the use of hydrogen sulphide, the copper in the foul electrolyte may be removed by electrolysis to any extent desired.

Sufficient Acid Regenerated

If hydrogen sulphide is applied, say, to wash waters, copper sulphide is precipitated, while an equivalent of acid is regenerated. This wash water may then be applied to the ore as an acid wash and becomes the electrolyte in proportion as foul copper solution is discarded. The precipitated copper sulphide applied to the electrolyte containing ferric salts reduces the iron to the ferrous condition, while the copper goes into solution as the sulphate, and is, in the regular working of the process, converted into the electrolytic metal, while an equivalent of acid is regenerated.

Reducing Action of Precipitated Copper Sulphide

Copper sulphide, especially the precipitated copper sulphide, makes an effective reducing agent: the precipitated copper sulphide is practically free from injurious impurities, and it is easily produced and easily applied. In hot solutions containing 3.5 gm. ferric iron per liter (0.35 per cent), a 90 per cent reduction can be made in five minutes at a temperature of 145 deg. F., with a slightly acid solution, and with occasional stir-

ring. Under the same conditions, at 62 deg. F., 56 per cent of the ferric iron can be reduced. Under the same conditions, by continuous violent agitation, in either hot or cold solution, the ferric iron can be completely reduced in one minute.

Reduction tests with copper sulphide, made on a copper solution that had previously been electrolyzed and reduced with sulphur dioxide, and containing, on the application of the copper-sulphide precipitate, 3.06 per cent total iron and 10.3 per cent acid, gave results as follows:

	Before	After
Copper, per cent	1.04	1.32
Ferric iron, per cent	0.48	0.07
Acid, per cent	10.30	9.16

That the reduction is fairly rapid, especially in heated solutions, is evident from the following results, when a solution was agitated with compressed air, with an abundance of copper-sulphide precipitate, and samples were taken of the treated solution at different intervals. Temperature, 50 deg. C.

	Ferric Iron, Per Cent	Acid, Per Cent	Total Iron, Per Cent
Before treatment with CuS	0.45	9.80	3.06
After five minutes' agitation	0.11	....	....
After fifteen minutes' agitation	0.12	....	....
After ninety-five minutes' agitation	0.14	....	....

These results indicate that the reducing action is quick and positive and that nothing is gained by prolonged agitation.

Practical Application

The lean wash waters and lean foul solutions from the electrolytic tanks flow into the hydrogen-sulphide precipitator, as shown in the diagrammatic section, Fig. 1, where the copper is precipitated with hydrogen sulphide. This hydrogen-sulphide precipitator is similar to the sulphur-dioxide reducers, so that a large pool of solution may be continuously and completely precipitated with the gas, and the gas will be entirely consumed. The precipitation is at all times under control, because the flow of the solution through the precipitator may be regulated at will, and the apparatus is sufficiently flexible to take care automatically of any unequal flow of gas.

The precipitate and barren solution, issuing from the precipitator, flows into a separator, which may be similar to a Dorr thickener, and the barren solution may be used again or discarded, while the thickened copper-sulphide precipitate is drawn off at the bottom in the form of a sludge, and flows into the agitator of the copper-sulphide reducing unit.

The ferric salt is quickly reduced with the copper-sulphide precipitate in the agitator, and the reduced and nearly clear solution from the agitator flows into another separator, where the clear settled solution overflows and is conducted to the last series of copper-depositing tanks, while the settled sludge is returned to the agitator. When the copper-sulphide sludge becomes undesirably contaminated with sulphur and impoverished in copper, it may be discharged from the copper-sulphide reducer.

The copper-sulphide reduction, like the sulphur-dioxide reduction, is preferably made by stages, especially in large plants. The electrolyzed solution, from which about 75 per cent of the copper has been deposited as the electrolytic metal, with a corresponding regeneration of acid, is then returned to the ore to pass through another complete cycle of solution, reduction, electrolysis and regeneration, but as the solution is returned to the leaching tanks, with the copper reduced from, say, 3.89 per cent at the inflow to 1.04 per cent at the outflow from the electrolytic tanks, a small portion is diverted from the main stream and further precipitated electrolytically, so that the copper in the diverted portion will not exceed from 0.25 to 0.50 per cent. This small amount of remaining copper is completely precipitated with hydrogen sulphide, and the resulting copper sulphide used as a reducing agent for the ferric salt in the electrolyte, while the copper is converted into the electrolytic metal, as described.

Precipitation of the lean and foul solutions by iron involves a number of serious difficulties: First, the iron and acid are lost. Second, it is inconvenient, if not impracticable, to handle the scrap iron and separate the cement copper automatically or mechanically. Third,

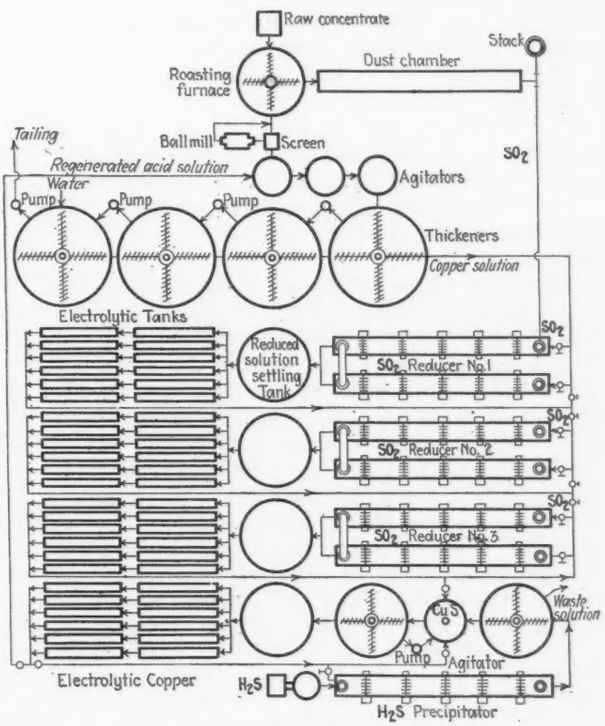

Fig. 3.—Greenawalt process applied to concentrates

15,000 to 30,000 lb. copper per day.

if the cement copper is used as a reducing agent for the ferric salts in the electrolyte, the action is slow, and the iron and other impurities foul the electrolyte to a serious degree.

Scrap iron is not usually obtainable at a reasonable price in copper-mining districts. If sponge iron is used, the cement copper will probably be so impure as to preclude its economical use in the reduction of the ferric salts and the conversion of the cement copper into the electrolytic metal. It takes about 2 lb. of iron, in practice, to precipitate 1 lb. of copper from electrolyzed solutions still containing over 2.0 per cent copper.

With hydrogen-sulphide precipitation of the copper from the lean and foul solutions, the acidity is immaterial; it is desirable to have them at least slightly acid to prevent the precipitation of undesirable impurities.

Copper sulphide applied to the electrolyte will produce about 3.0 lb. of acid per pound of copper deposited, by the Greenawalt process. If the hydrogen sulphide

is generated from acid and low-grade matte, the only extra expense is the matte, and that is easily obtainable at a cost that should not exceed $5 per ton.

Practical Application of the Greenawalt Process

The principal considerations which govern the practical application of the process are:

1. Sulphur dioxide is most effective as a reducing agent in solutions which are not too highly acid.
2. Cupric sulphide is more readily dissolved in high-acid solutions than in low-acid solutions. The reaction is also more energetic in warm than in cold solutions.
3. With effective sulphur-dioxide and cupric-sulphide reduction, the amount of copper requiring chemical precipitation may be small. It should not exceed from 0.25 to 0.50 per cent copper in the solutions discarded from the electrolytic plant, and should not exceed 5.0 per cent of the total copper produced.
4. It is desirable to have the entire output of copper in the form of the pure electrolytic metal.

Fig. 1 shows a diagrammatic section of the Greenawalt process, and Fig. 3 a diagrammatic plan as applied to the treatment of sulphide ore or concentrate. Low-grade oxidized ores are preferably leached by percolation; high-grade roasted ore and concentrates by agitation.

Referring to the drawings, it will be seen that the copper solution from the leaching plant is made to flow into Reducer No. 1, where it is treated with sulphur-dioxide gas obtained from roasting the sulphide ore of concentrate. Except for an ordinary dust chamber, no attempt is made to purify the gas or to remove the dust. The reduced solution, containing, say, 4 per cent copper, about 1 per cent acid, and from 3 to 4 per cent total iron, flows into the No. 1 settling tank, which is intended to be amply large to clarify the reduced solution. The ferric iron in the solution issuing from the first reducer will be practically completely reduced.

From the settling tank the solution flows in a continuous stream to the first group of copper-depositing or electrolytic tanks, and the rate of flow is regulated so that the solution flowing from the group of cells will not exceed a certain low limit of ferric iron, or, say, about 0.25 per cent. The electrolyzed solution is then returned to Reducer No. 1, but in returning it, a portion, the regular advance flow, is diverted into Reducer No. 2. The copper solution flows in a partly closed circuit in the electrolytic unit consisting of reducer and the corresponding group of cells until the copper content of the advance flow is about 3 per cent, and the acid about 4 per cent. That is to say, the solution circulates through the first electrolytic unit until about 1 per cent of the copper has been removed. Similarly, it circulates in the second electrolytic unit, consisting of Reducer No. 2 and the corresponding group of cells, until the advance flow shows about 2 per cent copper and about 7 per cent acid. Similarly, it circulates in the third electrolytic unit, consisting of Reducer No. 3 and the corresponding group of cells, until the advance flow shows about 1 per cent copper and about 10 per cent acid. The advance flow then flows into the copper-sulphide reducing unit, where the copper from the precipitate obtained from the lean and foul solutions is redissolved with the simultaneous reduction of the ferric iron, and the copper converted into the electrolytic metal.

The electrolyzed solution is then returned to the ore, but a small portion is continuously diverted to the hydrogen-sulphide precipitator, where all the remaining copper is precipitated, and the small diverted portion of the solution may be wasted. In this way the regular leach solution may be kept at any desired standard, which will usually be determined by the iron content, and which should not ordinarily be much below 3 nor much above 4 per cent total iron. To what extent it is advisable to remove the copper before the solution is returned to the ore is largely a matter of expediency. The inefficiency of the process, due to the acidity of the solution, does not make itself felt until the acidity exceeds about 7 or 8 per cent. As the acidity increases it becomes more difficult to reduce the ferric salts, but with a properly designed plant this can be offset by time and temperature, which are always under control.

It must be evident that the entire process can be carried out mechanically and that no unusual or unproved apparatus need be used.

Incidentally, it might be mentioned that with iron precipitation of the waste solutions the solutions wasted from the cementation plant will rarely show less than 0.02 to 0.05 per cent copper. Where about 25 per cent of the total copper produced is precipitated with scrap iron, this represents an appreciable loss.

The Problem of Depolarization

It has long been known that effective depolarization greatly reduces the power consumption and improves the general efficiency of copper deposition. Lead anodes are not as pronounced in their depolarizing action as carbon anodes. Under proper conditions, the deposition voltage may be reduced fully 50 per cent by the use of carbon anodes as against lead anodes. Carbon anodes cannot safely be used in sulphate solutions, on account of the excessive disintegration of the carbon. It has long been known, however, that with effective depolarization, carbon resists disintegration fairly well. Whether it can be made effective enough to be practical in sulphate solutions remains to be proved. The primary conditions for effective depolarization, are:

1. A high-iron electrolyte.
2. Iron in the electrolyte in the ferrous condition.
3. Agitation, or very rapid circulation, of the electrolyte during electrolysis.
4. A fairly high temperature of the electrolyte.
5. Low current density.

Up to now there has been little prospect of generally using carbon anodes in sulphate solutions, on account of the difficulty of maintaining the solution high in ferrous salts.

When it is considered that a reduction of 50 per cent in the voltage required for deposition means a 50 per cent saving in power, the possibilities in the use of carbon anodes are well worth considering.

The Greenawalt process, it is believed, offers the best chance for the realization of the conditions necessary for the effective use of carbon anodes.

Treatment of Copper Ores Containing Precious Metals

One of the problems frequently presented in the leaching of copper ores—especially the higher-grade copper ores and concentrates—is the recovery of the precious metals. This also applies to the leaching and electrolysis of low-grade copper matte.

Cyaniding of copper leach tailings is feasible in precious-metal ores containing copper, provided the copper extraction is fairly complete and the tailings are thor-

oughly washed. Cyaniding of copper *ores* containing precious metals is extremely difficult and usually entirely impracticable.

A chloride solution is capable of extracting the copper, gold, and silver, in one operation, but where electrolysis is concerned, it is best to leach the copper with a sulphate solution. This is also usually the best treatment for the precious metals, because, by using sulphate solutions for the copper, the precious metals are left in the residue, and can be extracted separately, preferably with a chloride solution. This involves an additional step in the treatment, but not necessarily an expensive step. The electrolytic generation of chlorine from common salt is now so common as to make its adoption free from any unusual uncertainty, and the chlorination of gold and silver ores is a time-honored process.

The application of the chlorine does not present the difficulty today that it did some years ago. Barrel chlorination would not be thought of now, and apparatus for the more effective application of chlorine than is possible by the barrel process can be designed in single units capable of treating from several hundred to a thousand tons of ore per day. This would be particularly easy if the ore contained copper and gold, and no silver worth recovering. The extraction of the silver would involve the use of a chloride solution; whereas, if gold alone were to be extracted, a simple chlorine solution would suffice.

In an experimental investigation of a high-grade Arizona copper-gold ore, containing 19.3 per cent copper, roasting and acid leaching showed an extraction of 96.3 per cent of the copper. The copper-leach residues assayed 0.9 per cent copper and 1.11 oz. gold. The tailing, after chlorine treatment, assayed 0.10 per cent copper and 0.02 oz. gold, showing a total laboratory extraction of 99.5 per cent of the copper and 98.2 per cent of the gold. These results are admittedly unusual, but the particular point of interest is that 0.80 per cent of the total of 19.3 per cent was extracted with chlorine. Manifestly, this represents a high chlorine consumption, for the chlorine will act more or less on the copper to the exclusion of the gold. It also indicates the close relation between the gold and the copper, and that when the copper is closely extracted a close extraction of the gold is also quite certain. This brings up the very pertinent question, as to whether the cost of the chlorine which acts on the copper makes the application of chlorine unprofitable. This is not the case, for, assuming that the copper is extracted as cupric chloride, it will take approximately a pound of chlorine to extract a pound of copper. The chlorine, generated from common salt by electrolysis, should not cost more than 5c. a pound; the copper extracted may be assumed to be worth 15c. a pound. This would leave considerable margin for the other expenses of extracting the copper, before a loss, or even possibly any expense, could be charged up to the gold on account of the copper.

Roasting of Sulphide Ores and Concentrates

The roasting of sulphide ores and concentrates for copper leaching presents a distinct problem, which involves two important considerations: First, to roast so as to get very low tailings, comparable to the recovery of the copper by smelting. Second, to make a high percentage of the copper soluble in water.

The roasting of copper ores to obtain a high recovery by leaching has recently been given a great deal of consideration by a number of competent investigators, and it is believed that satisfactory results can be obtained on most ores, even if the leach tailings are somewhat higher than most smelter slags.

The second consideration, however, can readily be realized, and there should be no difficulty in getting from 50 to 75 per cent of the copper water-soluble by roasting. This has an important bearing on the leaching and electrolysis, for enough acid can be regenerated by the electrolysis and application of the reducing agents for the ferric iron, such as sulphur dioxide and hydrogen sulphide, to meet all requirements, and no acid will have to be bought and none especially manufactured. In the treatment of oxidized ores this will not be true, but as 1 kw.-hr. at the a.c. switchboard will deposit 1 lb. of copper and regenerate 3 lb. of acid, by the Greenawalt process, it will be seen that the amount of acid to be purchased or especially manufactured will be greatly reduced.

An important advantage of leaching and electrolysis over smelting lies in the fact that metallurgically the leaching and electrolytic plants do not depend upon the capacity. Smelting on a scale of from 50 to 100 tons a day presents great difficulties. An electrolytic process can be operated in any unit. Of course, large-scale operations are more economical than small-scale operations, but this is independent of any inherent technical difficulties.

Attention should also be called to another point, which, indirectly, has an important bearing on copper mining. Where low-grade ores can be successfully concentrated, either by gravity or flotation, the percentage of recovery varies to a certain extent inversely with the grade of the concentrate, yet where the concentrate is shipped, or even smelted, it is important to make the grade high, to realize a reasonable profit, or even any profit at all. By the Greenawalt process there is no particular advantage in treating a high-grade concentrate, and hence the middling product, in the preliminary concentration, can go with the concentrate instead of with the tailing. This implies a comparatively low tailing and a considerably higher total recovery. Under most conditions it would not pay to ship a 5 to 10 per cent copper concentrate, yet this would be excellent material for the Greenawalt process. It could be treated without the purchase or direct manufacture of acid, and the power consumed in any electrolytic process is proportional to the copper deposited and not to the amount of ore treated.

The Sad Tale of the Turned-Down Prospector

Never yet was prospector found who would admit that his property was honestly turned down.

Dear Bill:—I take my pen in hand.
And hope you are the same.
That blarsted shorthorn beats the band—
He went and gummed the game.
I takes him out to see the dump,
And also down the shaft;
I thought he'd come in on the jump
But all he done was laughed.
I gets a letter yesterday.
It says: "Dear Mr. Brown,
I very much regret to say
I've turned your prospect down."
Now don't that skin you? say, I know
Just why that geezer laughed—
I never offered him no dough,
And he was out for graft!

—J. C. Murray

The Marketing of Platinum

United States Is Dependent Upon Foreign Supplies and Consumes Large Amounts of Platinum Metals in Jewelry, Electrical, Chemical, and Dental Trades—Prices Fluctuate Greatly—Metal Handled in Large and Small Lots

BY J. M. HILL*

ONLY one native alloy of the platinum-group metals is used in its original state. This is osmiridium, or, as it is known in the trade, "native iridium," which is used for pointing gold pens, because of its superior hardness. The value of the "point osmiridium" depends more on uniformity of size of grain than on chemical composition. Crude platinum is useful only as it is the material which is chemically refined to give the pure metals platinum, palladium, iridium, and osmium, and is therefore of interest only to the few refiners of platinum metals. Practically all the domestic refiners are also makers of semi-finished and completed articles for all the consuming industries. They buy the crude metal, separate the various metals of the platinum group from one another and from impurities, mix the pure metals into the alloys suitable for the different industries, and fabricate the articles demanded. The chief markets for crude platinum, which correspond rather closely to the centers of consumption, are London, Paris, Berlin, and New York. More limited markets in the United States are Philadelphia, San Francisco, and Los Angeles.

The following list of platinum refiners in the United States will serve also as a buyer's guide for those wishing to purchase all varieties of platinum articles:

American Platinum Works, 325 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., Murray and Austin Sts., Newark, N. J.
J. Bishop & Co., Malvern, Pa.
Sigmund Cohn, 44 Gold St., New York City, N. Y.
Thomas J. Dee, Mallers Building, Chicago, Ill.
Goldsmith Bros. Smelting & Refining Co., 20 John St., New York City, N. Y.
Gracier, Klink & Young, 409 Montgomery St., San Francisco, Calif.
Interstate Smelting & Refining Co., 29 Commercial St., Newark, N. J.
Kastenhuber & Lehrfeld, 24 John St., New York City, N. Y.
Pacific Platinum Works, 229 East 9th St., Los Angeles, Calif.
R. & H. Platinum Works, 709 Sixth Ave., New York City, N. Y.
Shreve & Co., Post and Grant Ave., San Francisco, Calif.
Wildberg Bros., 742 Market St., San Francisco, Calif.
H. A. Wilson Co., 97 Chestnut St., Newark, N. J.
Handy & Harman, 55 Cedar St., New York City, N. Y.

The apparent consumption of crude platinum in the United States in the last few years has been about 50,000 oz. a year, but the supply has been below normal for a number of years. In the United States the demand for refined platinum metals has been approximately 145,000 oz. during recent years, as is shown in the accompanying table[1]. About half this demand is filled by metals recovered from domestic and foreign crude platinum and by recoveries from gold, copper, and nickel refining, but importation of refined metals and the recoveries from sweeps and scrap materials is an essential part of the domestic supply. Prior to 1915 the annual consumption of platinum metals in the United States was about 160,000 oz., and it seems reasonable to believe that the future demand will exceed this amount as soon as the supply makes that condition possible.

The chemical industry uses platinum, palladium, iridium, and rhodium in the pure state and in alloys in various types of apparatus. Apparently the bulk of platinum apparatus contains from one-half of 1 per cent to 5 per cent of either iridium or rhodium, and very small quantities of iron and silica, which are detrimental. Salts of the various metals are used as reagents in the chemical laboratories,

CONSUMPTION OF PLATINUM METALS BY INDUSTRIES IN TROY OUNCES, 1918-1921

1918	Platinum	Palladium	Iridium	Total	Percentage of Total
Chemical	45,391	834	717	46,942	41
Electrical	24,982	594	3,107	28,683	25
Dental	11,461	7,371	418	19,250	17
Jewelry	13,541	42	721	14,304	12
Miscellaneous	5,435	212	339	5,986	5
Total	100,810	9,053	5,302	115,165	100
1919					
Chemical	10,759	63	41	10,863	7
Electrical	23,875	1,283	3,534	28,692	19
Dental	11,047	10,311	185	21,543	14
Jewelry	82,397	1,460	3,145	87,002	56
Miscellaneous	5,602	445	596	6,643	4
Total	133,680	13,562	7,501	154,743	100
1920					
Chemical	13,226	240	43	13,509	10
Electrical	23,029	1,784	2,673	27,486	19
Dental	6,413	8,898	114	15,425	11
Jewelry	77,267	593	3,108	80,968	57
Miscellaneous	3,119	418	116	3,653	3
Total	123,054	11,933	6,054	141,041	100
1921					
Chemical	12,273	45	34	12,352	7
Electrical	20,574	7,626	1,003	29,203	17
Dental	13,181	8,501	75	21,757	12
Jewelry	101,258	1,265	2,367	104,890	60
Miscellaneous	3,791	217	3,938	7,946	4
Total	151,077	17,654	7,417	176,148	100

The chemical industry is not considered a good or steady buyer of platinum metals. The electrical industry requires practically pure platinum and iridium to make the alloys for contact points. These alloys carry from 5 to 20 per cent iridium, dependent on the character of work they are to perform. It is understood that palladium-gold alloys are being used for telephone, telegraph, and signal equipment contacts, and rhodium-platinum alloys are used in the manufacture of thermocouples. Less expensive metals, particularly tungsten and nickel-chrome alloys, are used in some electrical equipment, such as heating elements, where platinum was formerly used.

The demand for platinum in the electrical field is good, but there is a tendency to develop substitutes which may further restrict this market. The dental industry consumes considerable amounts of platinum metals, but the recent developments are toward palladium rather than platinum. Palladium-gold alloys have been found entirely satisfactory for tooth pins, rivets, and for foil for the manufacture of artificial teeth. Formerly these articles were made of platinum and platinum-iridium alloys. The demand of the dental industry should continue good and may increase, for there is no immediate prospect of the utilization of base-metal substitutes for precious metals in this field.

Practically all of the jewelers' demand is for the 5 or 10 per cent iridium-platinum alloys, which are sold by the refiners in the form of sheet, wire, or semi-finished findings, such as rings and settings. The jewelers are the largest consumers of platinum in the world, as platinum has been found satisfactory for gem settings and its price is commensurate with the

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[1]U. S. Geol. Surv. Min. Res. Ann. Repts. on platinum.

value of the gems. Unless fashion should otherwise decree, there seems to be no reason why this market for platinum should not increase rather than decrease.

Crude platinum is sold in lots ranging from less than an ounce to hundreds of ounces; buyers, however, prefer not to handle lots of less than two ounces. For small lots settlement is usually made on the basis of recovered precious metals, each metal being paid for at the market price. Large lots are usually offered with an assay certificate from a reputable chemist. Sometimes sale is made on the basis of this assay, but more often on an adjustment of the seller's assay and an assay of a sample taken in the presence of the buyer. As the actual recoveries seldom equal the content shown by assay, some sales are made on a figure which is the average of the assay content and actual recovery. The latter method is not liked by sellers. As all crude platinum carries appreciable quantities of palladium and iridium, and some of the rare elements of the platinum group, as well as more or less gold and silver, all the precious metals are shown in the analysis and should be paid for by the purchaser.

Formerly the markets were so limited that buyers were in a position to dictate more or less the price of crude, and it has been said that in the past crude-platinum producers were really at the mercy of the few refiners. More recently, however, more buyers have entered the field, and reports indicate that the seller's position is better. Much of the dissatisfaction of sellers of domestic crude platinum seems to be due to lack of care on their part in cleaning the metal before trying to market it. Often large amounts of sand grains mixed with platinum particles necessarily reduce the value of the material to the refiner, and the returns from such shipments are not satisfactory to the producer.

As the platinum metals are very heavy, the volume of a package containing several hundred ounces is not large. Adequate packing for shipment to prevent loss is very important. Shipments of large size from South America are often doubly wrapped in specially tough, semi-glazed paper, sewn into tightly woven cotten cloth, which in turn is sewn into canvas and sealed. This package is placed in a box made of ⅞-in. boards to fit the parcel exactly, put together with screws, the heads of which are deeply countersunk and the holes above the screw head filled with sealing wax. For small shipments such elaborate packing is possibly not necessary, though every precaution against loss through breakage of the wrappings should be taken. Domestic platinum shipments are usually made either by insured parcel post, or express, the rate varying from one-half of 1 per cent to 1 per cent of the value. Insurance companies will insure shipments to and from foreign countries at a usual rate of one-half of 1 per cent, though some rates are lower.

The market for platinum, both crude and refined metal, is very sensitive, and prices vary from day to day, depending more on the supply of imported material than demand, though sellers of crude platinum watch the market closely for sudden changes in price. The strongest market is usually in the fall, when manufacturing jewelers begin making up stock for the holidays, for the jewelry industry is the largest and most steady buyer of platinum. The following table gives the range of prices of the three principal platinum metals for the last ten years. Although prices have decreased considerably since the war, they are still much above the pre-war level, and it is believed that high prices will prevail for some years, for supplies of crude platinum are short and will be short until the Russian fields again become a factor in the market.

PRICES OF THE THREE IMPORTANT PLATINUM METALS, PER TROY OUNCE, 1911-1921

	Platinum	Palladium	Iridium		Platinum	Palladium	Iridium
1911.....	$43.50	$55	$62	1917.....	$103.00	$110	$150
1912.....	45.50	55	65	1918.....	105.00	135	175
1913.....	44.88	50	65	1919.....	123.00	130	255
1914.....	45.00	44	65	1920.....	111.00	108	331
1915.....	55.00	56	83	1921.....	75.00	59	195
1916.....	84.00	67	94				

All dealings in the platinum metals are on a strictly cash basis, and no discounts are either asked or given. Though quotations are published each week, it is practically impossible to get a "firm offer" either to buy or sell that holds for more than forty-eight hours. All transactions for both crude and refined metals are based on the troy ounce of 480 grains. As the domestic production of platinum metals is practically negligible, imports of foreign crude are absolutely necessary to supply our refiners, and, as there is a world shortage of crude platinum, it is necessary to import considerable quantities of refined metals. English, French, and German brands seem to be equally acceptable, possibly because they pass through the hands of domestic refiners and makers, whose reputation is established and concerning the character of whose goods there is no question. As a matter of fact, the ultimate consumer rarely knows whether he or she has real platimnu or something of the same color. So long as the piece of jewelry or apparatus looks and acts as platinum should, there is little question as to the chemical purity of the metal.

Preservation of Mine Timbers by the Wolman Process

In an article in the August *Journal* of the South African Institution of Engineers, H. B. Stephens mentions the use of fluorine compounds in the preservation of wood. Most of the wood preservative processes are fairly well known, he says, but it may be of interest to refer to a comparatively new process which he has recently seen described and experiments with which were commenced in Europe some eighteen years ago. This is the Wolman process, in which wood is impregnated under pressure with a mixture of various salts: the composition of this mixture is a trade secret, but the principal components are fluor salts. There are said to be about eighty impregnating works that are using this process in Europe, and numerous testimonials and official reports are quoted testifying to the satisfactory results achieved by the method. The proprietors claim that this process is especially suitable for mining timbers and to have proved that it is considerably cheaper and more suitable in every way than creosoting or any other method of preservation, and that it even adds to the strength of the wood. Unfortunately, no figures of costs of treatment are given, but it is claimed, as an example, that whereas 132 to 175 lb. of creosote would be required for the impregnation of one cubic meter of wood, 9 lb. of Wolman salts would achieve the same results. In this connection it may be mentioned that sodium fluoride, as a result of extensive experiments which yielded very satisfactory results, has been put into use on a commercial scale for wood preservation in the United States during the last five or six years.

The Boarding House at Small Mines

A Record of the Cost of Feeding Miners Shows Importance of Giving Adequate Attention to a Proper Diet if Economy and Efficiency Are To Be Expected

BY C. N. SCHUETTE

THE IMPORTANCE of the boarding house as affecting the operation of mines has long been recognized, generally by the tacit acceptance of a loss in its operation on the part of the company. The operation of the boarding house by private interests not connected with the mine management is not as a rule acceptable to the men, who feel, and often not without reason, that they are not receiving the full worth of their money. Large mines can and do employ trained stewards to manage boarding houses, and can in some measure adjust the price charged to the actual cost of board. Neighboring small mines and prospects cannot charge more for board than the larger mines, but their cost of preparing meals is a larger factor in the total charges, because the cost of preparation is carried by a smaller number of men.

This article will show how the cost of board is affected by the number of men boarded. The basis of calculation will be the cost of food that was consumed at a small isolated mine in a period of three months. A charge of $1 per man per day was made for board at this mine. Some of the men employed lived in their own homes near the mine and ate only their noon meal at the company boarding house, for which they were charged at the rate of $1 for three meals, an arrangement of some disadvantage to the company, as the cost of the noon meal was more than one-third the cost of the three daily meals.

DETAILS OF EQUIPMENT

The boarding house was a substantial frame building of two floors and an attic. The lower floor contained the cook's quarters, kitchen, dining room, pantry, meat house, wash room, hall, and social room. The upper floor contained three large and four small sleeping rooms. Beds and mattresses were provided by the company, the men furnishing their own bedding. Heating stoves for the winter months were provided in the dining and social rooms, and meals were served at square tables seating eight men each. Eighteen men could be comfortably housed and boarded in this building.

A list of the mess equipment follows:

1 axe
1 double boiler
20 soup bowls
2 brooms
20 cups
1 can opener
1 meat cleaver
1 coffee grinder
1 alarm clock
1 egg beater
20 table forks
1 flour sifter
1 pancake griddle
1 bread knife
2 butcher knives
20 table knives
2 soup ladles
1 mop
2 pans
2 bread pans
1 dish pan
2 frying pans
1 mixing pan
4 pie tins
4 water pitchers
2 milk pitchers
20 dinner plates
14 platters
1 coffee pot
4 cooking pots
10 pot covers
1 tea pot
1 potato masher
1 rolling pin
1 kitchen range
1 meat saw
1 wood saw
20 saucers
20 teaspoons
20 tablespoons
2 kitchen spoons

The entire boarding house—that is, the building and all equipment in it, furniture, stoves, lamps, kitchen utensils, bedsteads and mattresses—is considered as one unit, and depreciated by a flat sum annually, while replacement of any equipment was charged to maintenance. Thus the boarding-house account contained no charge for rent, light, or depreciation.

A record of the food consumed was kept in an alphabetically tabulated list on the form reproduced below:

Food Supplies — Month of.....1921

Item	Unit	Number of Units Brought Forward and Bought	Cost	Number of Units on Hand at End of Month	Value

The difference in the summations of columns four and six gave the cost of the food consumed each month. To this was added the cost of transportation, fuel, and the cook's wages. This constituted the debit entry of the boarding-house account; the credit entry was the amount of board paid by the men.

Conditions for buying in quantity and cheaply were by no means ideal, and the number of men employed varied greatly. A list of the food consumed during a ninety-day period is given below:

Item	Unit	Number of Units	Cost	Cost per Unit
Apples	Gal.	3	$2.25	$0.75
Apples, dried	Lb.	41	7.60	.185
Apricots, dried	Lb.	22.75	8.55	.38
Bacon	Lb.	89	31.95	.36
Baking powder	Lb.	6.5	1.90	.29
Beans	Lb.	30	2.10	.07
Blackberries	Gal.	3	5.40	1.80
Butter	Lb.	48.5	24.25	.50
Cabbage	Lb.	52	2.35	.045
Cheese	Lb.	61.5	22.60	.37
Chocolate	Lb.	2	1.00	.50
Cinnamon	Lb.	1.0	.60	.60
Cocoanut	Lb.	1.5	.95	.63
Coffee	Lb.	45	20.00	.445
Corn	Can	40	7.70	.19
Cornflakes	Pkg.	34	5.75	.17
Cornstarch	Lb.	2.0	.25	.125
Crackers	Lb.	20	4.00	.20
Eggs	Doz.	73	22.25	.30
Flour	Lb.	575	22.50	.039
Ham	Lb.	37	13.25	.36
Lard	Lb.	70	14.10	.20
Lemon extract	Pint	1	1.75	1.75
Macaroni	Lb.	14	2.25	.16
Matches	Pkg.	2	.90	.45
Meat	Lb.	824	138.50	.17
Milk	Can	117	24.65	.21
Mustard	Lb.	4	2.80	.70
Oatmeal	Pkg.	9	1.80	.20
Onions	Lb.	30	2.90	.10
Peaches, dried	Lb.	22.75	5.50	.24
Peas	Can	12	2.40	.20
Pepper	Lb.	2	1.25	.625
Pickles	Gal.	5	6.40	1.27
Potatoes	Lb.	1004	34.10	.034
Prunes	Lb.	5	1.00	.20
Pumpkin	Can	8	1.60	.20
Raisins	Lb.	11	4.15	.38
Rhubarb	Lb.	30	2.10	.07
Rice	Lb.	20	2.00	.10
Salt	Lb.	30	1.40	.047
Soda	Lb.	2	.25	.125
Sauerkraut	Cans	12	2.40	.20
Spaghetti	Pkg.	12	1.25	.104
Sugar	Lb.	310	27.50	.09
Syrup	Gal.	9	17.05	1.90
Tapioca	Lb.	5	1.00	.20
Tea	Lb	5	4.10	.82
Tomatoes	Can	82	14 65	.18
Vanilla extract	Pint	1	1.75	1.75
Vinegar	Gal.	2	2.00	1.00
			$530.70	

The total cost of boarding-house maintenance is as follows:

Cost of food consumed in ninety days	$530.70
Freight	10.00
Haulage from railroad to mine	20.00
Fuel	10.00
Wages of cook	270.00
Total cost for a ninety-day period	$840.70

In these ninety days 2,313 meals were served, which is equivalent to serving three meals per day to a crew averaging 8.6 men during this time.

The board money received in this period at the rate of $1 for three meals was $771. This gives a boarding-house deficit of $69.70 in three months, or a loss of 3c. per meal, or 9c. per man per day.

In the above items of boarding-house expense, the cost of food, freight, haulage and fuel is roughly proportional to the number of boarders, but the cost of preparation—i.e., the cook's wage—does not vary, say, up to fifteen or twenty men. Leaving out the cost of preparation ($270), the remaining items total $570.70 for 2,313 meals, which amounts to 25c. per meal, or 75c. per man per day. Taking this as the fixed cost per unit of three meals per day, and the cook's wage of $3 per day as a variable cost depending on the number of boarders, it is possible to calculate how many boarders are necessary to make the boarding house pay, or the rate of board that must be charged for any given number of boarders if a deficit is to be avoided. This can be plotted in the form of a curve as shown.

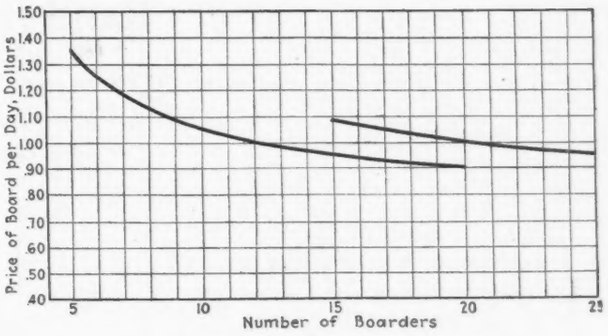
The curve shows that twelve boarders would be necessary to operate the boarding house without loss, at a rate of $1 per day for board. With fifteen men at that rate, a profit of 5c. per man per day would result. If twenty men were regularly employed, an assistant to the cook at $2 per day and board could be employed without entailing a loss in operation. (See upper curve.)

S. H. Brockunier, in his article "A Dietary for Miners" (*Engineering and Mining Journal*, April 6, 1918, p. 627) gives in Table I a proposed daily ration for miners. For purposes of comparison the list of food consumed during the ninety-day period was reduced to ounces per man per day, and the two lists of rations are given below:

DAILY RATION

Item	—Ounces as Purchased— Proposed by S. H. Brockunier	This Case
Meats	15.00	19.80
Eggs	2.50	2.26
Lard	.60	1.45
Butter	4.00	1.00
Cheese	1.60	1.36
Milk	4.00	2.43
Beans	2.50	.60
Potatoes	16.00	20.80
Peas	1.50	.31
Corn	1.30	1.04
Tomatoes	.50	3.00
Onions	1.70	.62
String beans	.50	....
Cabbage, rhubarb, pumpkin and sauerkraut	....	2.54
Coffee	1.00	.94
Sugar	3.30	6.43
Syrup	2.00	1.86
Chocolate	.09	.04
Jelly	.50	....
Flour	14.00	12.00
Crackers	....	.41
Pickles	....	.66
Oatmeal	1.30	.40
Rice	.30	.40
Cornmeal (cornflakes)	.30	.70
Cornstarch	.30	.04
Macaroni and spaghetti	1.00	.54
Fruits	4.00	3.40
Tea	.13	.10
Coffee	1.14	....
Total	81.26	85.13

A study of these two lists shows that though the individual items vary, the weights of the total rations are in close agreement. The variation in the different items is caused largely by the preponderance of noon meals served in the boarding house described. This is brought out particularly in the items meats and potatoes, the mainstays of the noon meal. Aside from these factors, the agreement is close enough to warrant the conclusion that even in small mines under adverse marketing conditions, and with a varying number of boarders, a suitable dietary can be maintained at reasonable cost if proper attention is given to this important subject.



Curve showing cost of board in relation to the number of boarders

Katanga Copper Developments

Recent copper discoveries by the Union Minière have demonstrated that the Katanga contains the greatest copper field in the world, and the position is greatly improved by the discoveries made by boring at the Ruashi mine, near the Star mine, during the past six months, according to the *South African Mining and Engineering Journal*. More than 1,000,000 tons of high-grade smelting ore have been located already in Ruashi, and this has changed the outlook for the better, and will probably cause a readjustment of the metallurgical program.

Probably more reverberatory furnaces will be installed at the Lubumbashi smelter. The erection of a big leaching plant at Panda has been postponed on account of the cost, but ultimately an immense leaching plant, driven by electric power on the Lufira and Lualaba rivers, will be installed at a cost of 500,000,000 fr. for the treatment of low-grade ores. The crushing and concentrating plant already erected at Panda has a capacity of 4,000 tons per day, and is the biggest individual ore plant in Africa.

The Panda plant is at present working at a little over one-third its capacity. The Union Minière's output for June was 4,000 tons of copper, and the company has under consideration plans which will increase the output gradually up to over 100,000 tons of copper annually, and may even result eventually in its reaching 230,000.

Sulphide ore has been encountered in the Luishia mine in depth, and immense tonnages are available in the Kambove and other mines. The tin fields appear to promise a profitable production, and immensely valuable tonnages of cobalt and radioactive uranium ores have been located. Coal has been found at Sankishia, and important experiments are in process with pulverized coal at Lubumbashi.

Rand Ore Reserves

The Life of South African Gold Mines as Indicated by Their Reports —Operations Since the War Greatly Influenced by Gold Premium

BY A. COOPER KEY

OWING TO THE HIGH WAGES paid to the white employees on the Rand and the high cost of supplies, working costs at the gold mines there last year rose to the unprecedented high figure of 25s. 8d. per ton[1] of ore crushed, compared with 17s. in 1914. This is a rise of 8s. 8d. per ton, or of just over 50 per cent. The position was saved by the existence of a currency premium on gold, owing to the depreciation of the pound compared with the United States dollar. The average yield for the forty-odd companies was 6.73 dwt., worth at the normal price of gold 28s. 7d. per ton. Thus, had gold remained at normal, the profit would have been only 3s. per ton, and the whole field would have made a profit of only £3,600,000 on the average position. Actually, many of the lower-grade mines would have been submerged by the burden of high costs, while certain of the richer mines, especially those of the Far East Rand basin, known popularly as the Modder group, would have survived. This would have spelt ruin to the Rand community, which lives rather on what the mines spend than on what they distribute by way of dividends. The more the mines spend short of the expenditure being so high as to extinguish mines altogether, the better for the local population.

A CURRENCY PREMIUM OF £8,000,000 LAST YEAR

The production of the Rand last year was 7,925,000 oz.; and the gold actually realized 105s. 9d. per fine ounce. Thus, the currency premium obtained amounted to the handsome sum of £7,958,500, the whole of which was profit. This enabled the mines, together with the profit applicable to gold at normal price, to pay dividends of £7,143,000, the balance being absorbed in government taxation, which is a distinctly heavy item; capital expenditure, loan and debenture interest, head office charges, and so forth.

The premium of 20s. per oz. represents about 6s. 8d. per ton on the average, inasmuch as the mean grade is about one-third of an ounce. Some mines go as poor as 5 dwt., others as high as 10 dwt., which translates into a premium of 4s. and 8s. per ton respectively. The signficance of the premium is shown in the accompanying table. In some cases the premium was as great as the whole profit. In extreme cases—for example, Geldenhuis Deep and East Rand Proprietary mines—the premium was many times as great as the profit.

The currency premium has recently waned, and it became necessary to adjust the Rand position to the altered conditions. The only safe basis was to take gold at the normal price, 85s., and to regard any premium as a bonus or windfall. No industry could afford to continue to be based upon an elusive, ephemeral, and fluctuating currency premium. For the months of April and May, the price of the metal was assumed by the Chamber of Mines at 92s., a premium of only 7s. per ounce. The Chamber gave notice of reduction in white wages, such as has taken place in mining and other industries throughout the world, but this was opposed by the unions; hence the long and disastrous strike of January and February. There was no scope for reducing native wages, and store prices were determined by world prices.

[1]The English ton of 2,240 lb. is meant throughout this article.

RAND'S "LIFE" TWELVE OR THIRTY-FIVE YEARS?

The high range of working costs of 25s. 8d. per ton seriously reduced the amount of available ore existing on the Rand. According to a statement presented by the Chamber of Mines to the Mining Industry Board, appointed by the South African Union Government to report upon various questions arising out of the strike, the total tonnage which could be profitably mined at that high figure would be only 316,000,000 tons of the present producing mines. As the Rand crushes about 24,000,000 tons a year, these high costs would mean that the productive future was limited to little more than a dozen years. But a reduction to the pre-war standard of 17s. would increase the available quantity to 544,000,000 tons, which would give a duration of twenty-two and one-half years at the current rate of production. This corresponds closely with the 550,000,000 tons estimated as contained in the then producing mines, according to evidence submitted by the Chamber of Mines to the Economic Commission in 1913. Considerable tonnage has been milled in the interval, but there are now several important mines (especially Government Areas, Modder Deep, and Springs Mines) included in the producing category which were not crushing nine years ago. Moreover, the earlier estimate was based on working costs at 18s. 6d., whereas the present

PREMIUM AND PROFIT AT INDIVIDUAL RAND MINES

	Profit £	Premium £	Per ton
Aurora West	6,559	33,600	5/6
Brakpan Mines	(a) 590,866	295,185	8/11
City Deep	711,516	441,376	8/10
Cons. Langlaagte	172,480	151,600	6/3
Cons. Main Reef	129,838	204,724	7/2
Crown Mines	672,030	688,123	6/4
Durban Deep	31,605	109,344	6/10
E.R.P.M.	78,258	420,497	5/5
Ferreira Deep	126,993	121,279	6/7
Geduld	369,566	196,650	7/3
Geldenhuis	2,516	161,666	5/8
Government Areas	1,762,490	692,181	8/7
Knight Central	30,636	83,659	4/11
Langlaagte Estate	149,756	153,329	6/4
Luipaardsvlei Estate	46	53,156	4/6
Meyer & Charlton	293,400	98,277	12/1
Modder B	1,012,729	384,697	10/7
Modder Deep	916,824	287,290	11/2
Modder East	140,977	125,565	8/3
New Goch	14,367	45,626	4/7
New Kleinfontein	65,025	158,015	5/7
New Modderfontein	1,517,830	554,140	9/6
New Primrose	38,594	57,830	4/6
New Unified	24,207	31,102	4/8
Nourse Mines	61,465	170,910	6/7
Randfontein Central	245,319	454,635	6/2
Robinson	24,000	97,810	4/2
Robinson Deep	179,799	218,883	6/3
Roodepoort United (loss)	14,309	52,571	4/0
Rose Deep	124,907	168,838	4/11
Simmer & Jack	90,925	167,780	4/9
Springs	397,803	215,746	8/11
Van Ryn	98,404	114,164	5/11
Van Ryn Deep	922,918	352,400	11/6
Village Deep	112,746	195,634	6/5
West Rand Cons.	45,898	112,400	5/9
Witwatersrand	91,054	122,633	5/6
Witwatersrand Deep	83,700	118,270	5/10
Wolhuter	44,510	94,825	5/0

(a) Includes £100,620 placed to reserve during the year, and taken to credit Dec. 31.

is framed on 17s. per ton. Making allowance for this, the estimates are in fairly close agreement. There are in addition approximately 300,000,000 tons existing in other areas rendered available with costs at the lower figure, which would extend the period to about thirty-five years.

The foregoing figures refer to the tonnage of rock *in situ* in the various mining properties from the Far East Rand to Randfontein. An analysis of the ore reserve figures of about forty companies shows that there are collectively developed 80,250,000 tons. Of this, practically half, or, more exactly, 36,250,000 tons, is estimated as being in reserve in seven mines of the Far East Rand. The only mine of the central section whose aggregate is comparable with that of the big mines of the Far Eastern section is the Crown Mines, with 8,500,000 tons, but, unfortunately, its value is only just over 6 dwt. per ton, in contrast with the 8½ dwt. of the richer mines of the Benoni (or Eastern) section.

Eight and Ten Million Ton Aggregates

The largest aggregate is the 10,250,000 tons of the Government Gold Mining Areas, to which is assigned a value of 8½ dwt. over a stoping width of 77 in. This mine is noted for the great channel width of its reef, which, for the payable development last year, averaged no less than 57 in. I may mention incidentally that no less than 1,625,500 tons was crushed last year for 665,819 oz. of gold, or 8.57 dwt. per ton. Out of a profit of £1,772,200, the government took no less than £896,181 as its share. Next in strength of ore reserve comes the New Modder, with little short of 9,000,000 tons, valued at 8.4 dwt. over 66 in. In this case, however, the actual reef is much thinner, probably not more than 9 or 10 in. throughout the mine, but very rich.

From the foregoing huge aggregates it is a big drop to the 4,375,000 tons, averaging 9¼ dwt., at Modder Deep, the 3,500,000 tons of the Geduld Proprietary Mines, the 3,250,000 tons of the Van Ryn Deep, averaging 8 and 9 dwt. respectively, and the 3,000,000 of Springs Mines, averaging near the higher figure. Modder B. and Brakpan, each with some 2,500,000 tons or more in reserve, practically complete the list of the important producing mines of the Far Eastern section. A new mine lying south of Government Areas, and known as the New State Areas, has, however, developed upward of 500,000 tons averaging 8 dwt. over 67 in. An all-sliming plant is expected to be in operation (capacity 50,000 tons monthly) in the second quarter of next year.

Central and East Rand Reserves of Low Value

But the foregoing represents the "cream" section of the Rand gold field. Very different is the case of the central and western portions. The great Randfontein Central vies with some of the eastern mines in magnitude of tonnage; it has well over 4,000,000 available, but the value is but a trifle over 6 dwt., and that over a stoping width of only 49 in., the payable "leader" being a thin body of ore. Then we have great mines just outside Johannesburg, the Robinson and Village Deeps, each with a couple of million tons developed, but with a value of only 6½ dwt. With reasonable working costs, say about 20s. a ton, they have a couple of decades of profitable work in front of them, but at a range of 27s. 6d. to 30s. the position is almost hopeless, except in the event of a high currency premium. Or take the case of the East Rand Proprietary Mines, which has 2,000,000 tons in sight, valued at less than 6¾ dwt., but which until the strike was on the verge of closing down, owing to unpayability and the scattered character of the ore reserve. The trouble is that a third of the Rand's developed tonnage has a value of 6½ dwt., or less, namely 27,000,000 tons out of 80,000,000. This represents but 27s. 6d. at the par price of gold, whereas last year working costs averaged 25s. 8d. With a reduction to 22s. 6d. or 20s. per ton, with the mills running full time, and the reduction in wages to pre-war rates as from June 30, the position is once again re-established on a stable foundation.

The ore reserves of Rand companies may be classified as under:

Value	Tons
5 to 6 dwt.	6,766,813
6 to 6½ dwt.	20,317,545
6½ to 7 dwt.	8,807,194
7 to 7½ dwt.	nil
7½ to 8 dwt.	3,176,200
8 to 8½ dwt.	22,686,700
8½ to 9 dwt.	7,907,760
9 to 9½ dwt.	10,465,300
10 dwt. and over	679,887

Taking the mines whose reserves are over 8 dwt., all but two are in the Far Eastern Rand area. These two high-grade mines are the phenomenally rich and successful Meyer & Charlton, which has paid over £3,000,000 in dividends, whose comparatively small ore reserve has a value of nearly 14 dwt., or nearly 50 per cent better than the best of the Modder group of mines, and the City Deep, the most promising of Central Rand mines, which has 2,500,000 tons in sight averaging rather under 9 dwt.

The following table gives a complete list of ore reserves at latest date and the corresponding period of a year previous:

RAND ORE RESERVES

Producing Companies	As at December, 1920. Tons	Dwt.	In.	As at December, 1921 Tons	Dwt.	In.
Aurora West	32,050	7.3	42	136,700	6.9	42
(a)	80,570	5.5	42	28,300	5.9	42
Brakpan	2,526,517	8.88	70	2,423,230	8.6	68
City Deep	(b) 3,099,200	9.0	66	(b) 2,428,300	8.8	66
Cons. Langlaagte	1,339,000	6.2	51	1,371,000	6.5	51
Cons. Main Reef	1,186,000	7.6	49	1,176,500	7.5	49
Crown Mines	(b) 8,131,700	6.4	62	(b) 8,511,200	6.1	....
Durban Rood. Deep	(b) 1,094,900	6.6	49	(b) 1,092,400	6.5	....
East Rand Prop.	2,410,850	6.1	59	1,946,650	6.7	59
Ferreira Deep	993,174	7.8	....	780,314	7.7	....
Geduld Prop.	3,220,000	8.0	61	3,545,000	8.1	....
Geldenhuis Deep	1,467,100	6.1	53	914,200	6.7	....
Govt. Areas (Modder)	10,291,000	8.2	77	10,232,000	8.5	77
Knights Central	150,700	6.1	....	(b) 147,800	5.6	....
Langlaagte Estate	1,016,800	6.4	55	950,000	6.4	54
Luipaardsvlei Es.	645,000	5.51	....	701,850	5.2	....
Meyer & Charlton	450,050	14.1	54	395,887	13.8	56
Modder B	3,006,600	8.6	64	(b) 2,773,300	9.6	63
Modder Deep	4,100,000	9.4	77	4,375,000	9.3	....
Modder East	1,611,700	7.7	57	1,913,900	7.1	58
New Goch	48,717	6.9	46	47,479	6.7	44
	56,915	5.0	50	(d) 15,958	5.6	48
New Kleinfontein	(g) 1,623,500	5.32	58	(g) 1,325,333	5.18	57
New Modderfontein	8,869,700	8.4	66	8,884,600	8.4	66
New Primrose	26,500	7.6	54	25,100	8.3	53
New Unified	83,000	6.2	46	38,900	6.2	44
Nourse Mines	1,513,600	6.8	51	1,589,030	6.9	51
Randfontein Central	3,593,410	6.2	49	4,142,100	6.2	49
Robinson	115,200	....	....	....	....	....
Rose Deep	3,060,000	5.1	....	2,564,430	5.2	....
Robinson Deep	1,597,000	6.97	65	1,936,000	6.7	66
Roodepoort United	249,108	5.8	41	82,772	6.0	40
	....	....	....	(f) 141,844	5.5	40
Simmer & Jack	1,230,000	5.53	78	1,081,000	5.7	76
Springs Mines	2,726,178	8.76	63½	3,056,231	8.9	61.5
Sub Nigel	359,000	10.4	44.2	(c) 284,000	10.0	42
Partial	36,000	9.8	....	....	....	....
Van Ryn	1,147,170	5.6	52	864,583	6.1	48
Van Ryn Deep	( ) 3,260,000	9.7	72	3,317,000	9.2	73
Village Deep	2,381,200	6.1	....	2,087,700	6.3	55
West Rand Cons.	1,205,199	6.5	49	1,169,695	6.7	48
Witwatersrand	(c) 774,500	6.0	63	547,300	5.8	63
Witwatersrand Deep	1,018,390	6.3	....	1,067,440	6.6	....
Wolhuter	661,904	5.7	62	(b) 399,100	5.6	....
Non-crushing companies						
Cinderella Cons.	( ) 1,024,800	7.0	....	(c) 1,024,800	7.0	....
Suspense	436,000	....	....	436,000	....	....
New State Areas	....	....	....	482,000	7.9	67

(a) Or latest date in respective years, Cons. Main Reef, Luipaardsvlei, New Modder, Modder East, Nourse, Sub Nigel, Simmer & Jack, and Van Ryn Estate, June 30th.
(b) Includes shaft and boundary pillars. (c) Mining tons. (d) Total tonnage with gold at 98s. per oz. (e) Mr. Denny's report. (f) Extra tonnage with gold at 95s. (g) On 1914 basis.

THE PETROLEUM INDUSTRY

Prospecting for Oil in Australia and Papua

SPECIAL CORRESPONDENCE

A second sample taken from the Roma oil bore, Queensland, Australia, at a depth of 2,815 ft., has been proved by analysis to contain no petrol, but is nevertheless considered by the Minister for Mines to be "satisfactory." The constituents of the sample included 13.1 per cent of bitumen, 13.5 per cent of this being petrolene and 0.6 per cent asphaltene. Besides the bitumen, the specimen contained 41.5 per cent of water, 20.3 per cent of organic matter other than bitumen, and 25.1 per cent of ash. Calculated on the dry sample, the bitumen is equivalent to 24.4 per cent, the petrolene 95.4 per cent, and the asphaltene 4.6 per cent. The residue, after the removal of the bitumen, gave oil when heated to redness, and the fumes had the smell characteristic of shale.

It has been decided to open up the well, by means of explosives, at the point from which this sample was taken, to shut off the water with cement, and explore the surrounding strata with a view to ascertaining whether oil in commercial quantity is present. The bore from which the oily mud recently found has been taken at 2,815 ft. is a hole deflected from the original well at 2,400 ft., in an endeavor to bore past broken tools obstructing that well lower down. The sinking of the deviated hole the 400 ft. now achieved has been such a difficult and tedious process that it is doubtful whether it will be resumed, even if the present exploratory work at 2,815 ft. proves unsuccessful. The petroliferous gas zone reached in the original bore when the bit became jammed and the stem broke was at 3,705 feet.

Attempts made two months ago to form a company to prospect for oil at a place called The Narrows, near Gladstone, on the coast of central Queensland, appear to have failed, as they were expected to, but it is now stated that fresh steps are being taken to carry out boring in this locality. As far as petroleum prospects are concerned, there was really no trustworthy geological data, and the proposed organization of a prospecting company was considered a gamble. The only indication in favor of prospecting is that oil shales have been found in the vicinity.

A report which the Prime Minister considers encouraging has been received from A. Gillespie, the Papuan oil fields superintendent of the Anglo-Persian Oil Co., Ltd. In two places examined in this country oil indications had been found, but in one early investigations did not disclose a structure favorable to the retention or conservation of oil in commercial quantities, and in the other, where strong petroleum conditions had been found to exist, the strata were considerably faulted, and no recommendation to drill was made. In the carrying out of prospecting in other recommended areas, however, drilling in a bore at Popo had reached a depth of 1,380 ft. early in July, when it was reported by wireless that at that depth the bore was in sandy shale and was making gas, and that the quantity would be tested when something harder was reached on which to set the casing pipe. This report the Prime Minister, speaking, it is to be presumed, on the advice of experts, considers distinctly hopeful and the most encouraging sign of oil-bearing country yet received from Papua.

Barbers Hill, Texas, Has New Gusher

SPECIAL CORRESPONDENCE

Drilling throughout north and central Texas is not as extensive as usual, judging by the few good completions made lately. Richland, the north extension of the Mexia and Currie region, and Young County are the two most active areas. In Young County, the Tyrell Oil Co. recently completed a 200-bbl. well in the bed of the Brazos River. This and other discoveries have stimulated drilling in the county.

In Wichita County the completion of a 150-bbl. pumper at 1,260 ft., and several smaller producers at 780 ft., on the Parker ranch, has caused a leasing boom, and land is selling for $1,000 per acre.

A gas field of considerable size is being developed in the western limits of Eastland, where four wells have a combined production of 30,000,000 cu.ft. of gas from 3,200 ft. Another gas field has been opened by the Texas Co. in Montague County. Two wells at shallow depth, about nine miles north of Nocona, have a combined output of 20,000,000 cu.ft. This gas will be used for fuel in deeper drilling for oil, which is expected at about 2,000 ft.

The outstanding feature of recent developments in the Gulf Coastal area was the completion of a 2 400-bbl. gusher at Barbers Hill by the Bennett-Hardman-Pugh interests. This is the No. 2 Japhet well, on the southwest flank of the dome, and is 3,221 ft. deep. Barbers Hill was proved to be a salt dome years ago, but only a small production of oil has been made to date. This well will stimulate drilling in general and force offsetting, and renew interest in this field.

Government to Ask Bids on Oil Now Sold to Shipping Board

The Department of the Interior has decided to call for bids in the near future for the royalty oil accruing to the government in the Salt Creek and Cat Creek fields, in Wyoming and Montana respectively. This oil heretofore has been sold to the Shipping Board, but on the expiration of the present contract competitive bids will be sought.

At present the royalty oil in the Salt Creek field amounts to 8,200 bbl. per day. In the Cat Creek field it is averaging 500 bbl. per day. As these are high-grade, paraffin-base oils, and as it is believed that the production in each of these fields will increase, and because the contracts are to be for five- and ten-year periods, the amount of oil involved is large.

USEFUL OPERATING IDEAS

Counterbalancing a Small Hoist at the Hibernia Mine

BY FELIX EDGAR WORMSER

MANY MINES in the western United States use unbalanced hoisting of ore and waste. This practice is often the outgrowth of the original development of the mines, in which the governing primary consideration is to sink shafts quickly and cheaply to ascertain the extent of the deposits. Later, when operations have increased in scope, shaft and hoisting equipment are often left unaltered. Unbalanced hoisting is inefficient and costly in the use of power, and decreases the output of a mine.

To overcome the objections to unbalanced hoisting, the Davis-Daly Copper Co., of Butte, Mont., remodeled the hoisting plant of its Hibernia mine—a silver mine on the western outskirts of Butte—and installed a counterbalance. This work was done under the direction of James L. Bruce, general manager, and S. A. Worcester, plant engineer of the company, to both of whom I am indebted for details.

Hoisting at the Hibernia mine was done through a two-compartment shaft by means of an Ottumwa hoist working unbalanced in one of the compartments. A double-deck cage hoisted and lowered mine cars weighing 1,100 lb. each. The depth of the Hibernia shaft is 758 ft. and the height of its headframe 45 ft. from axis of sheaves to the collar of the shaft.

To take maximum advantage of the provisions of the Pittman Act, with its dollar-silver provision, it was necessary to work the mine to capacity. A greater output, however, was definitely limited by the design of the hoisting equipment. Plans were made to provide a counterbalance and to speed up the hoist. They included altering the hoist engine and utilizing the space of the manway and ventilating compartment to build a narrow compartment for the counterweight.

The Ottumwa hoist consisted originally of a drum 48 in. in diameter with a 36-in. face and an outside flange 6 in. deep; pitch diameter of drum gear, 65⅞ in.; pitch diameter of countershaft pinion, 12¼ in. The hoist is what is known as a second-reduction, single-drum, electric hoist, with post brakes and friction clutch, a type commonly used in many mines. The motor driving the hoist is a three-phase, 440-v. 690-r.p.m., 112-hp. machine. A ⅞-in. steel rope is used for hoisting.

The main hoisting level is the 600, and conditions governing the redesigning of the hoist follow:

	Pounds
Weight of rope, 600 ft. @ 1.2 lb. per ft.	720
Weight of cage	2,000
Weight of cars (two)	2,200
Weight of ore	2,800
Total starting dead weight	7,720
Friction at 10 per cent	772
Total starting weight and peak load	8,492

The Hibernia mine, looking east. Big Butte, after which the city was named, is in the background.

To counterbalance the weight of cage plus the weight of two cars and one-half the weight of ore, a counterweight was built of steel and concrete to weigh 5,600 lb. Its design is shown in Fig. 1, and when first placed in operation it was found to contain an insufficient amount of heavy reinforcing, so that it was lighter than had been calculated. But even with this partial counterbalancing, it was found that 77 hp. was required for lowering and 125 hp. for hoisting a full load, after making important modifications of the hoisting engine construction. An addition has been made to the counterbalance weight, which has practically equalized the load at 102 hp. on both up and down trips, which is well within the rating of 112 hp. given the motor.

A balanced hoist permits of an increase in the size of drum used and a consequent greater speed of hoisting. In changing over from unbalanced to balanced hoisting at the Hibernia mine the drum was increased

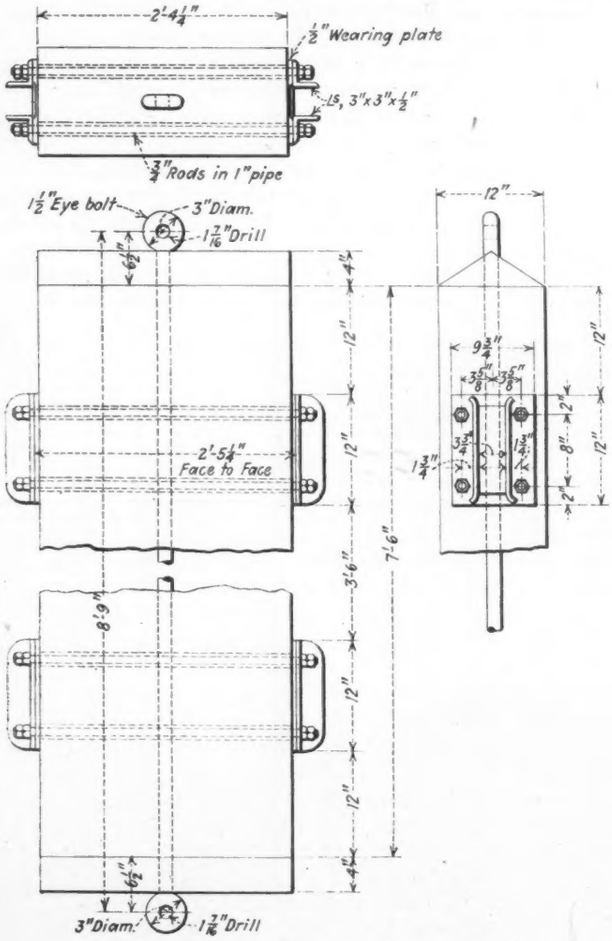


Fig. 1—Sketch of counterweight

6 in. in diameter and a specially designed flange was built to divide the drum face into two parts. Details of the flange are shown in Fig. 2, and the method of attaching it to the drum is shown in Fig. 3. The flange was riveted to the drum, and a shell of ½-in. boiler plate placed around the face of the drum on suitable steel strips to increase the drum diameter 6 in. These changes are indicated by Fig. 3, showing a section of the drum. On the cage side of the drum the rope winds directly on the ½-in. shell, whereas on the counterweight side the drum surface itself is used. In

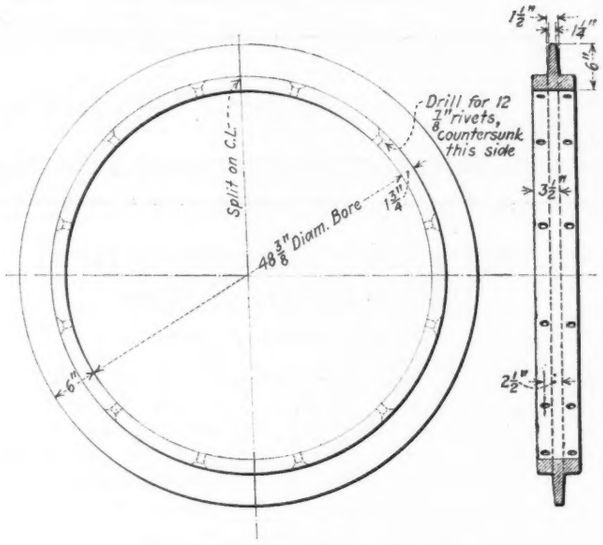


Fig. 2—Sketch of extra flange

enlarging the drum diameter wood was tried at first, but its use was abandoned.

A sheave 6 in. smaller in diameter than the one used on the cage side was used for the weight, and this has given no trouble worth mentioning. The rope windings were inclined to spread apart a little when first put on, but after they had run a short time this tendency disappeared.

The saving in power gained by using a counterbalance enabled a larger pinion to be used on the motor. The original installation was provided with a ten-tooth pinion, which was replaced by a twenty-five-tooth and finally a twenty-eight-tooth pinion.

All these changes have naturally altered the operating speed of the hoist and the capacity of the mine. The rope speed called for originally was 400 ft. per minute. Increasing the drum diameter and the size of the motor pinion brought the speed up to about 700 ft. per minute. The up and down trips (758 ft. each) are now made in slightly over sixty-three seconds, so that with the small hoisting equipment 2,005 tons of ore has been hoisted in seven days of three shifts each without straining equipment, including, also, hoisting of men and timbers and other mine supplies, a splendid record for a mine the size of the Hibernia.

Fig. 4 shows the changes that were made in the construction of the shaft to provide room for the counterweight. The 6x6-in. crosspiece shown in Fig. 4 and to which one of the counterweight guides is attached is spiked on top of the 10x10-in. shaft members, and

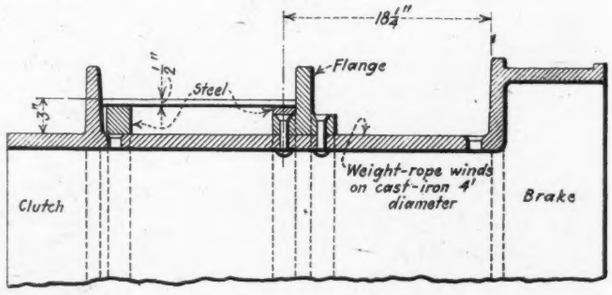


Fig. 3—Sketch showing method of enlarging drum diameter

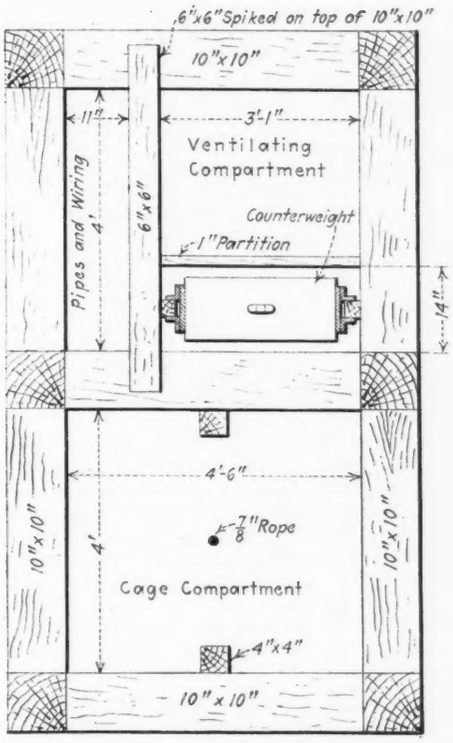


Fig. 4—Plan of shaft, showing arrangement of compartments

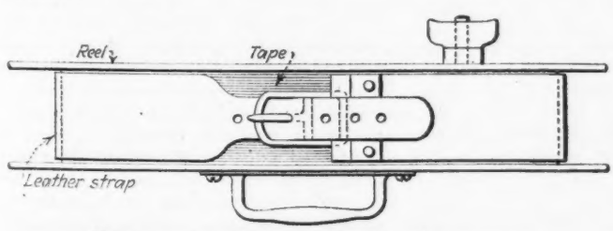
the 3x3-in. guides are lag-screwed to the sides. The ventilating compartment is reduced in width by 14 in. and a 1-in. board partition constructed to separate it from the counterweight compartment. This has given room for the necessary pipe and for the wiring compartment.

The change from unbalanced to balanced hoisting has been entirely successful and gave no trouble from the start. A similar arrangement was made about twelve years ago at the Findley mine, in Colorado, by Mr. Worcester, which proved to be a profitable guide in making alterations at the Hibernia hoist.

A Leather Cover for Tapes

BY ROY H. POSTON

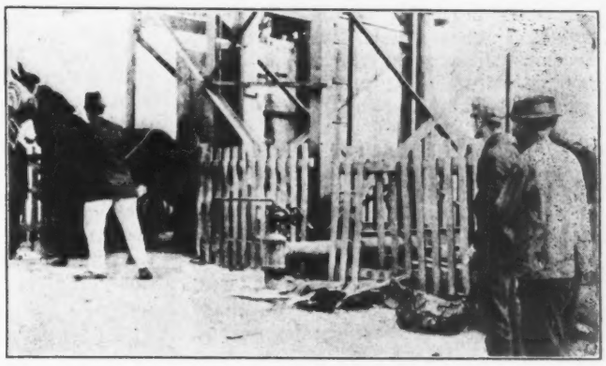
Some reels on which long wire tapes are wound have no provision for fastening the loose end of the tape while not in use and as a consequence cause a great deal of annoyance and an occasional break of the tape. An effective method for preventing this condition is illustrated—consisting of a leather strap that will just fit into the reel sides and then buckle over the tape snugly. This holds the tape firmly in position and in addition serves as adequate protection against injury.



Tape secured by buckled leather cover

Lowering a Mule Down a Narrow Shaft

To lower a mule down a narrow shaft, the mule is first blindfolded and after being backed up to the box-like cage shown in the background of the photograph, is literally "stood up" on his haunches therein, and the doors are then securely closed to hold him in this position. This method is necessary at a certain southeastern Missouri mine, as the cageway is less than five feet square. Upon reaching the bottom of the shaft it is only necessary to open the doors and then stand in the clear.



Ready to start underground

Since the box cage provides rather close quarters for the mule, a man rides on top of the cage and holds the mule's head in an upright position by means of a halter while the cage is being lowered.

Building a Tailing Dam With a Mechanical Classifier

BY A. W. ALLEN

The construction and maintenance of level of the walls of a tailing dam usually require much attention and manual labor of an unattractive kind. The hand shoveling of wet material deposited near the walls is tiresome, particularly when it is composed largely of sticky slime.

At the plant of the Randsburg Silver Mines, Inc., at Randsburg, Calif., the tailing is conveyed by pipe to the dam, where it is separated into sand and slime by a Dorr classifier. The classifier and motor to drive it comprise a self-contained unit, which is perched on the edge of the dam. The fine sand discharged by the rakes of the classifier forms a wall, the slime flowing to the inclosure. As the building of the dam progresses, the classifier-motor unit is moved forward.

The innovation indicates the application of ore-dressing principles and equipment to construction work, and the further utilization of the fundamental idea may well be forecast. A feature of the result is that the tailing is deposited according to physical characteristics, thus simplifying the problem of future re-treatment in those instances where such is practicable; for classification usually results in a rough grading according to metal content. In a dump formed in the customary manner the finest slime usually occurs in seams and pockets, or irregularly distributed throughout the mass. Further, the settling capacity for flocculent slime of the area available is reduced in proportion to the amount of sand that settles immediately and occupies space near the point of discharge of the tailing launder or pipe.

New Books

El Oro and Tlalpujahua

Estudio Geologico-Minero de los Distritos de El Oro y Tlalpujahua. By Teodoro Flores, Instituto Geologico de Mexico. Boletin num. 37. Mexico.

The valuable little monograph records the work of the author over a period of years, beginning with the epoch of political upheaval in Mexico. With the various drawbacks which the author acknowledges in his preface, his study will very likely remain the most complete which we shall ever have of the El Oro-Tlalpujahua districts, the chief gold-bearing district in Mexico, in which lie the famous mines of El Oro, Esperanza, Mexico Mines of El Oro, and Dos Estrellas. There is a geological map in colors of the two districts, and various very valuable sections and projections of the veins and mine workings, as well as some interesting photographs.

The Tlalpujahua district has been worked since shortly after the Conquest (1521); but El Oro was not worked till 1787. Around 1743 Don José de Laborde (de la Borda), a Frenchman, worked a famous bonanza which yielded gold and silver ore to the amount of 33,000,000 pesos. At a relatively recent epoch (1899-1900), another Frenchman, Fournier by name, cut two rich veins in the Dos Estrellas mine, of which the most productive was the Veta Verde (the Green Vein). At El Oro three companies, El Oro Mining & Ry. Co., Esperanza Mining Co., and the Mexico Mines of El Oro, cover all of the principal veins. The San Rafael vein is the most important in the El Oro district, traversing all the properties above mentioned.

The districts are nearly 3,000 meters above the sea, and the climate is cool.

Thick folded shales of presumably pre-Cretaceous age are cut and overlain by igneous rocks. Dioritic, diabasic, and syenitic intrusions in small quantity occur near Tlalpujahua. Rocks of volcanic type belong to at least two periods, pre-mineral and post-mineral. The intrusive andesites do not appear at the surface. Surface volcanics include andesites and basalts.

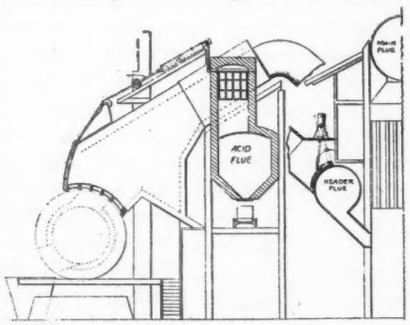
The ore deposits of the districts are fissure veins, which are later than the intrusive igneous rocks and older than the surface volcanics. A system of faults cuts the veins. The author assigns the intrusive andesites to the Miocene, the surface flows of andesite to the Pliocene. The veins were formed directly after the andesite intrusions, and are considered by the author to have filled pre-existing cavities. The veins attain a width of as much as seventy meters (p. 41). (The reviewer, who is familiar with the district, does not concur in this explanation of pre-existing cavities. The theory of the existence of extensive open fissures, up to seventy meters in width, in shale, is not one that an experienced miner would support.) The outcrops of these veins were buried under the later volcanics. The author explains the formation of the cavities into which he believes the veins were infilled, by differential movement along a wavy fault plane, in the familiar theoretical manner that has been imagined by many geologists. The veins have an average strike of N. 25 W., with a southwest dip at El Oro and in the Dos Estrellas mine, and a northeast dip in the Tlalpujahua veins, constituting, accordingly, a conjugated system.

The veins are separable, according to the author, into two groups; essentially auriferous veins, very wide, with predominant quartz gangue, and essentially argentiferous veins, relatively narrow, and with a predominant calcite gangue. The vein filling is compact, or banded, or orbicular and concentric, often of breccia form. Primary minerals are auriferous pyrite, stephanite and pyrargyrite; some blende, galena, and chalcopyrite. There is no barite nor fluorite in the gangues. Small rich veins appear parallel to the large veins, and are believed to be due to a reopening of the fissures (p. 75); their filling is often of a nature distinct from the main veins. The period of vein formation is stated as probably at the end of the Miocene; the predominantly auriferous veins are thought to be older than the argentiferous veins. The absence of fluorite, or other minerals containing fluorine, chlorine, or boron, shows that these "mineralizers" played no part in the formation of the veins.

J. E. SPURR.

Recent Patents

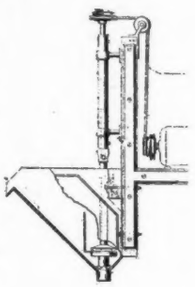
Converter Flue—No. 1,417,538. A. G. McGregor, Warren, Ariz. A method of making a close contact between a horizontal copper converter and its flue, designed to prevent the admission of external air, which dilutes the gas for acid making. The design is indicated in



the accompanying illustration. Another design for the same purpose is covered in patent No. 1,417,588, issued to Charles Van Amburgh, Tacoma, Wash., assignor to American Smelting & Refining Co.

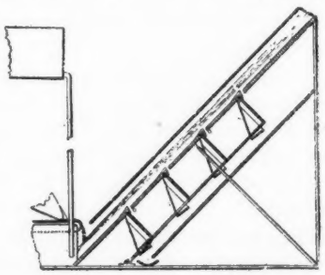
Concentrating Table—No. 1,417,681. G. A. Overstrom, Pasadena, Calif. This patent covers the table with an unbalanced wheel for a head motion, which has become quite generally known in the West under the name of the Overstrom Universal table.

Flotation Machine—No. 1,417,895. A. W. Fahrenwald, Moscow, Idaho. An experimental flotation machine with spindle extending above the cell, the belt being driven by a small motor. Variable speed is secured by the use of different pulleys.



Ore Leaching—No. 1,417,947. Walter Schopper, Frankfort-on-the-Main, Germany, assignor to Metallbank und Metallurgische Gesellschaft, Aktiengesellschaft, Frankfort-on-the-Main, Germany. A process and apparatus for counter-current leaching of ore.

Concentrator—No. 1,421,984. Frank Ondra, Johannesburg, Transvaal, South Africa, assignor to Concentrators, Ltd., Johannesburg. Ground ore falling from a belt is caught by a high-pressure



stream of water and carried up an incline, the mineral and gangue particles then falling through openings arranged at intervals, the particles being distributed into various receptacles, each receptacle having particles of the same weight but differing as to size. The mineral particles, of course, are the smaller. By means of sizing, the mineral is then separated from the gangue.

Lead Refining—No. 1,418,148. Henry Harris, London, England. Method of charging molten reagents into lead-refining pots.

Chloridization—Canadian patent No. 219,168. J. J. Collins, Southport, Lancaster, England. Powdered zinc, lead, and sulphide ores are introduced into a solution of the lower chloride of a metal which forms both a lower and a higher chloride and then chlorine gas is introduced into the solution, whereby lead chloride is formed while the zinc sulphide remains substantially unattacked. The solution is then drawn off from the undissolved material and precipitates, the solid residuum treated with a hot saturated solution of sodium chloride to dissolve the lead chloride, leaving zinc sulphide and sulphur, and finally the residue is treated to reclaim any silver contained therein.

SOCIETIES, ADDRESSES, AND REPORTS

American Mining Congress Meets at Cleveland

Sidney J. Jennings Elected President—Conferences on Mine Taxation and Standardization Receive Most Attention—Many Resolutions Passed—Next Convention To Be Held at Milwaukee

IN CONTRAST with the meetings held by the American Mining Congress in Chicago, Denver, and St. Louis during the last three years, the "twenty-fifth annual and anniversary" convention which the organization held at Cleveland during the week of Oct. 7 was an unusually quiet affair. The controversial questions debated in previous years had been settled or were no longer of moment. Minerals Separation's compromise had wiped flotation litigation off the slate earlier in the year. War minerals relief legislation had been liberalized, and tariff wishes largely gratified, both of these with the aid of the organization. The Gold Bonus bill, already moribund last year, was long since dead. In fact, there was no old issue left to fight about, unless it were taxation, that perennial source of discontent, and unwonted calm prevailed. The delegates were therefore able to consider in all serenity the two main and highly important topics on the program—namely, standardization and mine taxation.

New issues, not yet well crystallized, were brought forward. One of these dealt with the matter of remedying the serious labor shortage hampering ore and metal producers all over the country. Another was the question of how the silver market might be stabilized when purchases of the metal under the Pittman Act had been completed. Resolutions covering these subjects were passed by the convention and are printed on page 732.

Some speculation was heard as to what effect the recent organization of a Western Division of the Congress, with headquarters in Salt Lake City, and the still more recent steps taken to organize a Southern Division, would have on future conventions of the national body, especially if each division were to hold its own conferences on matters affecting its members. Much interest was shown in the Manufacturers' Division, organized during the year, with the twofold purpose of making it easier to finance the annual machinery exhibit and of increasing the manufacturers' interest in the affairs of the congress.

Cleveland may seem rather too far east for a convention which is expected to interest western metal-mining men, though admirably situated for a gathering of coal producers. Despite this fact the western states were fairly represented, though coal men and machinery exhibitors were in the majority among those who registered. The exposition of mine equipment was admirably housed in the magnificent new Public Auditorium, where, also, most

Sidney J. Jennings, newly elected president of the American Mining Congress

of the sessions of the convention were held. Convention headquarters were close by, in the Hollenden Hotel.

The program this year was fortunately little crowded, as in other years, by conflicting sessions, so that most delegates found it possible to be present when the subjects that interested them were discussed. In addition to the conferences on taxation and standardization, there was one session on oil shale, at which Victor C. Alderson presided. Coal topics were considered at one of the general sessions, and the subject of industrial relations at another. Papers and addresses of general or popular interest characterized these sessions. Among the speakers were Carmi A. Thompson, of the Tod-Stambaugh Company, who talked on "Some Requirements of the Iron Ore Industry"; H. W. Seaman, of the Trojan Mining Co., of South Dakota, whose topic was "Gold Mining and Its Problems"; and W. A. Willis, of the Copper and Brass Research Association, who spoke on "Increasing the Uses of Copper."

W. J. Loring, president of the Mining Congress during the last two years, was absent, having recently been made a member of a board appointed to investigate the Argonaut disaster in California. At the annual election, Sidney J. Jennings, vice-president of the United States Smelting, Refining & Mining Co., was elected to succeed Mr. Loring. D. D. Wentz, H. W. Seaman, and E. L. Doheny were selected as first vice-president, second vice-president and third vice-president, respectively. James F. Callbreath was re-elected secretary. Three new directors were chosen: William H. Lindsay, of Nashville, Tenn.; W. C. Doering, of St. Louis; and Albert J. Nason, of Chicago. The new executive committee consists of Mr. Jennings, Mr. Wentz, and Robert Linton.

It was decided to hold the next annual convention in Milwaukee.

Though the formal opening of the convention was set for Monday evening, the first session, that of the Mine Taxation Conference, actually was held on Monday afternoon. It was well attended. In the absence of Paul Armitage, H. B. Fernald, of New York, occupied the chair. This conference was to be devoted primarily to questions of federal taxation. However, the report of the committee on state taxation, appointed at Chicago last year, was presented by the conference secretary, McKinley W. Kriegh. This stated that the question of taxation of mines was wholly dependent upon the system of general taxation and finance in each of the states, and that it seemed impossible to make any recommendations looking toward a uniform system of mine taxation applicable to all the states, without at the same time recommending a standard system of general state taxation and finance, of which mine taxation was a part, until the committee could compile more fully the basis of taxation for other industries. To do this, the committee felt, would require more study and time than the scope of its work would permit.

The committee believed that the con-

gress should have a complete library on mine taxation, to be kept in Washington, and that co-operation with the United Engineering Societies' Library in New York to this end should be sought. Copies of a bibliography on mine taxation, prepared by the tax division and comprising 240 titles, were circulated among the delegates.

In the discussion which followed, Robert I. Kerr, of California, said that he felt it was impossible to have a system of taxation uniform in all states. George E. Holmes said that an exhaustive study of the subject would cost more than the funds available would warrant.

C. E. Jarvis, of the California State Board of Control, reviewed briefly the method of assessing gold mines in California, stating that in twelve years not one mining company had asked for a reduction.

At the second session on mine taxation, W. R. Ingalls, of New York, read a paper on the subject of "State Taxation of Mines in General." He cited various instances to show the difficulties of valuing mines for taxation, with particular reference to cases in which the Union Sulphur Co. and the New Jersey Zinc Co. were involved. In closing, he proposed certain fundamental rules for the guidance of assessors who are not versed in the mining industry and made several suggestions as to the valuation of mining property.

"Mine Accounting Methods in Relation to Federal Taxes" was the subject of a paper by T. O. McGrath, of Arizona. In this Mr. McGrath considered principally the matters of (1) earned surplus as of March 1, 1913; (2) depreciation, repairs and replacements; (3) inventories and costs; and (4) undelivered sales. Mr. McGrath said that the Treasury Department apparently intended originally to recognize trade customs in the accounting methods of taxpayers, provided they conformed to the best accounting practice in the trade or business and were consistent, but that now its regulations were gradually crystallizing into a fixed system that must be met by all, regardless of trade practices.

Paul Armitage, of New York, chairman of the general committee on mine taxation of the American Mining Congress, presented a live paper on "Distributions From the Depletion Reserve Under the Federal Tax Laws." The question he discussed was: Can distributions from a "reserve for depletion" be made to the stockholders, and, if so, under what conditions and limitations, and what is the effect of such distributions? In his treatment of this subject Mr. Armitage divided it into three parts: (1) Under what conditions and limitations may distributions from a depletion reserve be made; (2) the effect on the taxable status of the corporation under the Federal Income and Excess Profits Tax laws; and (3) the effect on the similar status of the stockholders receiving the same.

Another paper read at this session was entitled "Accounting for Depletion and Dividends of Mining Companies," by Henry B. Fernald. In recommending the system of accounting set forth, Mr. Fernald took the provisions of existing law and existing regulations and decisions of the Treasury Department as the basis for the accounting. The recommendations made were not advanced, however, to present a method of accounting to be followed blindly, but the speaker intended that every step should be considered by any company from the point of view of what its officials and attorneys believed to be the proper statement of facts and law applied to its own affairs.

"Special Relief" under the revenue acts was the subject discussed by Major Robert N. Miller, of Washington, D. C., formerly solicitor, Internal Revenue, Treasury Department. "Special relief begins where the technical part of the law quits," said Major Miller. "The administration of special relief is still a difficult and vague thing, and there is yet much to be known about it and developed." He explained special relief, saying, "The law has rules by which technical net income and technical invested capital and technical taxation are calculated. Although we have this way of getting a definite solution which is theoretically correct, when we have done the best we can, we have another way of softening that taxation, which way is based on what other taxpayers (in comparable cases) pay. That is surrounded and limited by certain rules, but is roughly what is done."

George E. Holmes, of New York, discussed some phases of invested capital of mining corporations in a paper thus entitled, and made some remarks on the fundamental principles on which the federal excess profits taxation system is founded. He treated his subject under the heads (1) cash paid in; (2) tangible property paid in; (3) intangible property; (4) paid-in surplus; (5) earned surplus and divided profits; (6) depreciation reserves; (7) depletion reserves; (8) dividends; and (9) changes during the taxable year. He also made a comparison of the statutory provisions relating to invested capital in the 1918 and 1921 acts as against the Oct. 3, 1917 act.

A. H. Fay, Chief of the Natural Resources Division of the Internal Revenue Department, had prepared and described what he termed the "tax return flow sheet," showing the course followed through the various units of the Income Tax Unit by a return from the time it is filed with the local Internal Revenue collector. Many interesting facts regarding the work of his division were given by Mr. Fay.

Following Mr. Fay, E. H. Batson, Deputy Commissioner of Internal Revenue, was introduced. He said that of the returns for 1917 to 1920 there now remain but 28 per cent to be audited and (to his regret) that the biggest returns were those from the mining industry. In referring to his position he jestingly termed himself the "official shock absorber of the government."

The Taxation Conference concluded with a brief paper entitled "Settlements and Compromises with the Commissioner of Internal Revenue," by McKinley W. Kriegh, secretary of the Tax Division of the American Mining Congress. In it he called attention to a provision of the 1921 law, thus far uninterpreted, bearing, in his estimation, on the problem met by mining companies in the reopening of cases which to all intents and purposes had been closed by assessment, and payment of abatement or refund of taxes after full investigation by the government during which repeated hearings had been accorded the taxpayers.

Standardization Conference Has Long Program

Evidence of the work and study done during the last year by the various subcommittees of the Standardization Division of the Mining Congress was afforded by the reports of these committees, which had been printed in pamphlet form for distribution among the delegates. The Metal Mining Branch and the Coal Mining Branch met jointly at the various sessions of the Standardization Conference, with either Charles A. Mitke or Colonel Warren R. Roberts, chairmen of the two branches respectively, in the chair.

The conference began on Tuesday afternoon with the presentation by Mr. Mitke and Colonel Roberts of general statements of the work done by their respective branches. That many of the problems of standardization require a long period for their solution, stretching over years possibly, was pointed out by Mr. Mitke and was further indicated in the reports themselves. Though conditions in the industry are greatly improved over what they were last year, nevertheless, on the whole, it has not been possible in the last twelve months to do as much experimental work as was desirable.

Two things were emphasized by Mr. Mitke. In referring to the use of ventilation for the elimination of dust (discussed in the report on mine ventilation) he said:

"The committee have found. . . that unless they bring out good concrete suggestions of what they found to be best, there is a possibility of the pendulum swinging, in this country as it has in other countries, where the idea is to lay the dust by using an abundance of water until they come to the point of saturation and lower the efficiency of the men. . . Whenever you have men practically, working in water all the time it is not conducive to good work. That has happened in some countries where the pendulum has swung in that direction. . . Then, the pendulum has swung in the other direction, where they believe in eliminating the water altogether and use air only and keep drawing the dusty air out of the mine with air only. That has brought up certain questions. . . The committee recommends a medium course, using a certain amount of water and a large volume of air."

In referring to mechanical loading underground, the subject of one of the subcommittees, Mr. Mitke said:

"One of the crying needs of the mining industry is a mechanical shoveling machine for use in small drifts, approximately 5 by 7 ft. In mentioning a 5 by 7-ft. drift I do not mean to intimate that these dimensions should be selected as the standard size for small prospect drifts or tunnels. . . What we do need, however, is a shoveling machine that can be used in small prospect drifts of approximately this size, and which will load a small train of about six cars without the necessity for switching. There are already a number of mechanical shovels on the market that can be used with more or less success in larger drifts and tunnels, such as 8 by 10 ft., 10 by 10 ft., etc., but not sufficient attention has been given to the small prospect tunnels."

Lucien Eaton, of Ishpeming, Mich., presented the report of the subcommittee on Standardization of Mechanical Loading Underground. Recommendations were made in this as to the choice of loading machine, power, supply of ore or rock, safety, transportation, repairs, personnel, and wages. It also made recommendations as to the size of scrapers used on sublevels, main levels and in large stopes, and as to the hoists used with them. The subcommittee is said to have so covered its subject that it is now ready to start on original work.

In presenting the report on the Standardization of Mine Timbering, Gerald Sherman, of Douglas, Ariz., said that by standardizing square timber, the framing of it at a central plant in a given district might be encouraged, or timber merchants might be led to put up mills to ship framed timber, though this, he said, would not be of great importance to the bigger companies. The report, in addition to suggestions as to size, framing, and design of timbers, recommended that criticisms be invited on the designs proposed, as well as suggestions as to other classes; that data be collected on size and spacing of ties under various loads and rail weights; that experiments on use of timber preservatives be urged and available data published; and that information on gunite be collected and disseminated.

In the discussion of this report, during the course of which guniting was considered, B. C. Collier, of the Cement Gun Co., said "If you are considering the advisability of using gunite as a means of protecting the roof against slacking, I advise you not to do it unless you are willing to put on at least three-quarters of an inch of coating (in two coats)."

In the absence of W. B. Daly, of Butte, Mont., chairman of the subcommittee on Standardization of Underground Transportation in Metal Mines, the report of that committee was presented by C. L. Berrien, of Butte. This committee has progressed far enough to ascertain definitely that there is a great variety of underground transportation equipment of all kinds. It is faced with problems in making recommendations from the large amount of undigested material it has accumulated. Concrete recommendations from the committee are expected this year, according to Mr. Mitke.

William Conibear, of Ishpeming, Mich., chairman of the subcommittee on Metal Mine Fire Fighting Equipment, presented a brief report, making specific recommendations regarding oxygen rescue apparatus, fire extinguishers, water supply, hose, and control of ventilation.

Interior of Cleveland's Auditorium in which the Machinery Exhibit and most of the sessions of the American Mining Congress' convention were held

Charles A. Mitke presented the report of the subcommittee on Metal Mining Ventilating Equipment and Practices. In this was assembled a large amount of data, covering thirty-four printed pages. Mechanical ventilation was recommended for all mines. The report was against the general installation of equipment permitting reversal of air currents at will, though two members of the subcommittee were in favor of reversible fans. These were D. Harrington, of the U. S. Bureau of Mines, and A. S. Richardson, of the Anaconda Copper Mining Co. It is well known that Anaconda has favored installing equipment that was reversible. The committee majority, however, considered such practice to involve an element of danger.

The report on Steam Shovel Equipment summarized the subcommittee's questionnaire. Much experimentation and investigation remain to be done. Recommendations are expected during the coming year.

Progress was also reported for the subcommittee on Drilling Machines and Drill Steel, which made such an exhaustive report last year. It is apparent that considerable experimentation must now be done.

The report of the subcommittee on Metal Mine Accounting was presented by T. O. McGrath, of Bisbee, Ariz. This committee is working on a solution of problems of reporting general mining costs. At present most mining companies have their own individual cost systems, one of which is generally compared with another only with difficulty.

Subcommittees on Mine Drainage, Milling and Smelting, and on Methods of Mine Sampling have recently been organized. The last named has sent out a questionnaire, but has not yet had opportunity to digest the returns.

The convention closed on Friday evening with the annual banquet, which was held at the Hollenden Hotel. During the week a smoker was held at the Auditorium by the exhibitors at the Exposition of Mines and Mining. Special provision had been made for the entertainment of the ladies accompanying the delegates.

The following resolutions, together with others formally expressing thanks, were adopted by the convention:

1. *Industrial co-operation.* Introduced by H. F. Lunt, of Colorado.—Resolved, that the Committee on Industrial Co-operation which has been organized by the American Mining Congress has the full endorsement and approval of this convention, and that the American Mining Congress, through the Board of Directors, be directed to further the general plan by all means within its power; and be it further,

Resolved, that employers and employees throughout the country be urged to co-operate in a general movement which shall have for its ultimate accomplishment harmonious relations, continuous employment, fair wages, reasonable profits, and the cheapest priced commodities to the consumer which these conditions will permit.

2. *Against paternalism.* Introduced by Bruce C. Yates, of South Dakota.—Resolved, that the American Mining Congress pledges its co-operation to eliminate all unnecessary paternalistic activities upon the part of national or local governments.

3. *Transportation costs.* Introduced by T. O. McGrath, of Arizona.—Resolved, that a Committee on Transportation be appointed and directed to make detailed research into the relative costs of transporting raw materials and the charges made for such transportation service, as compared with the charges on other commodities, to the end that the mining industry may be advised as to whether the charges paid by it are fair and equitable as compared with the charges for the transportation of the products of other industries.

4. *Blue-sky legislation.* Introduced by H. W. Seaman, of South Dakota.—Resolved, that the American Mining Congress strongly favors whatever legislation may be needed to safeguard the public against fraudulent promotions of all kinds, but condemns all measures which set up individuals or commissions

to pass without appeal upon investments and all legislation which embodies the principle of the so-called Denison Blue-Sky Bill, violates individual rights, and destroys that initiative upon which the mining industry of the United States has reached its present proportions.

5. *Oil shale.* Introduced by the Oil Shale Division. — Resolved that the owners and holders of oil-shale placer locations be advised to maintain and perfect their titles to the lands included in said locations.

That the Department of the Interior be urged to define specifically what character of labor and improvements shall be acceptable as annual labor, and that the department in defining such annual labor, so define it that the work to be done will be of substantial value in the development of the property and of lasting benefit to the industry.

That the Federal Government be urged to provide funds which will permit the Bureau of Mines and the Geological Survey to continue and expand their research in connection with oil shales which is so vital and necessary to the progress of the industry.

That the Federal Government provide funds sufficient to permit the General Land Office to re-survey those townships in the oil-shale area for which the surveys are incomplete or confusing.

That all members of the Oil Shale Section, and all others interested in the welfare of oil shale, be urged to use every effort to prevent the promotion of fake oil shale schemes by reporting all organizations of any kind entering the oil shale field to the promotions investigating committee, and to assist in the prosecution of persons violating the laws and to furnish all possible data to those authorities charged with the prosecution of such cases.

6. *Coal situation.* Introduced by the Resolutions Committee.—Resolved, that the American Mining Congress, in recognition of the situation in the coal industry, directs that a committee of seven members, representative of the entire mining industry, be appointed to tender its best services to both the Congressional Fact-Finding Commission and the coal industry in presenting such information to the commission as will aid it in making recommendations that tend to stabilize the industry and to safeguard and protect the rights of the public.

7. *Labor Shortage.* Introduced by the Western Division.—Whereas, the basic industry of metal mining is suffering acutely from lack of man-power, due, among other causes, to our present immigration restrictions, and as agriculture, building, manufacturing, and other vital activities must also suffer widespread and continued depression unless metal mining is enabled to function properly; and therefore, be it further,

Resolved, that a committee be appointed at once to investigate the present labor shortage and report to the board of directors of the American Mining Congress, so that the board may provide for such action as shall afford relief.

8. *Silver situation.* Introduced by A. G. Mackenzie, of Utah.—Be it resolved, that a committee be appointed at once by the American Mining Congress to study the silver situation and to recommend such constructive action by legislation or otherwise as will anticipate and provide for the condition in which the industry will be placed upon the termination of purchases under the Pittman Act.

9. *State taxation.* Introduced by the Tax Conference.—Resolved, that the report of the special Committee on State Taxation be accepted as read at this conference and that the thanks of the American Mining Congress be extended to the members of said committee and to those who co-operated with them; and,

Resolved, that since it seems impossible to obtain uniformity in mine taxation until such time as the various states agree to uniformity in the principles of general property taxation, the subject of improvement in methods of local taxation of mines be referred to the tax committees of the several chapters of the American Mining Congress; and,

Resolved, that subjects of general interest in mine taxation be referred to the Standing Tax Committee, with power to confer with and aid the tax committees of the several chapters; and,

Resolved, that a general tax committee be created to be composed of one member from each state, to co-operate with the standing tax committee of the American Mining Congress on all matters of general interest in taxation. The members and officers of the standing tax committee of the national organization shall be ex-officio members and officers of such general committee; and, be it further

Resolved, that the Board of Governors of the several divisions appoint, at this session, or as soon thereafter as practicable, from each state within their jurisdiction, one man to be a member of such general tax committee, and that where a state is beyond the jurisdiction of the Board of Governors the standing tax committee be authorized to select from each of such states one man to act on such general committee.

10. *Government expenditures.* Introduced by the Tax Conference.—Resolved, that this congress hereby voices its belief that the expenditures of our government can and should be materially reduced by eliminating all expenditures not actually necessary for the proper and efficient conduct of the government and by confirming such expenditures as are necessary to the minimum called for by sound common sense and business principles, and

Resolved, that this subject of reduced expenditures is of such vital importance that it demands prompt consideration and effective action by our legislators, our officials, and our citizens, and be it further

Resolved, that this convention calls upon the citizens of the country, whether or not members of this organization, to give definite thought and serious consideration to the means by which unwise, extravagant, or unnecessary public expenditures can be restrained in their respective communities and states, as well as in the nation, and to give their active support and co-operation to those legislators, officials, and other citizens who are striving to effect economies in government expenditures.

11. *Against restrictions on business.* Introduced by Albert Nason.—Resolved, that the American Mining Congress support such amendments to our laws as will enable administrative governmental agencies to be organized or reorganized, with such power as to enable them to remove all unreasonable restrictions now imposed upon the conduct of business, so long as the removal of such restrictions shall not be injurious to the public.

12. *Standardization.* Introduced by the Standardization Division. — Resolved, that the American Mining Congress strongly favors the continuation of the work of the Standardization Division and urges the adoption by the mining industry of the comprehensive and helpful recommendation already made by this division.

13. *Water-power development.* Introduced by the Southern Division.—Resolved, that the American Mining Congress endorses the sound economic policy of the development of our water-powers, under such provisions of general law as will prevent monopoly and insure adequate power to communities and industries which may be economically served therefrom and developed thereby.

14. *Against strikes and lockouts.* Introduced by the Resolutions Committee. —Resolved, that this congress, in no equivocal language, expresses its belief that strikes or lockouts in essential industries should be impossible, as they are destructive to the life of the commonwealth; and be it further

Resolved, that laws should be made and enforced by all the power of the government that shall forever strip labor organizations as well as employers of the ability to interfere with the production and distribution of the necessities of life.

Mining Congress Organizes Southern Division

A meeting was held at the Patten Hotel, Chattanooga, Tenn., Sept. 29, 1922, for the purpose of creating a Southern Division of the American Mining Congress. Henry M. Payne, of the American Mining Congress, occupied the chair.

Among the speakers were James F. Callbreath, National Secretary of the American Mining Congress; Herbert Wilson Smith, chief of the organization's Division of Economics and Tariff; A. B. Aldridge, of Birmingham, Ala.; Forrest Andrews, of Knoxville, Tenn.; John H. Adams, of Birmingham, Ala.; and Walter R. Crane, superintendent of the Bureau of Mines, Tuscaloosa Station. Most of the speakers referred to the rail transportation problem in their speeches, emphasizing the need for relief from "car shortage."

J. B. McClary, Birmingham, Ala.; Lee Long, Dante, Va.; Percy D. Berry, Providence, Ky.; Wm. H. Lindsey, Nashville, Tenn.; J. F. Wheless, Raleigh, N. C.; C. O. Bartlett, Miami, Fla.; E. L. Hertzog, Spartanburg, S. C.; C. C. Houston, Monroe, La.; and W. S. Peebles, Carterville, Ga., were elected to the board of governors.

MEN YOU SHOULD KNOW ABOUT

E. E. McCarthy, of the Yukon Gold Co., was recently in San Francisco.

R. S. Rose, of Pasadena, Calif., has been visiting recently on the Gogebic Range.

A. I. D'Arcy, Goldfield mine operator, has returned to Goldfield, Nev., from San Francisco.

John G. Meyer, managing director of Big Dyke Gold Mines, Ltd., has sailed for England on a business trip.

F. J. Siebert has returned to Reno from a three weeks' examination trip to southern California and Arizona.

Charles B. Croner is making a survey of various Oregon and California properties for Utah mining interests.

J. B. Eby has completed work for the U. S. Geological Survey in the Wasatch Plateau coal field, in south central Utah.

James W. Wade, manager of the Tintic Standard mine, in Utah, has been visiting New York City and Washington, D. C.

J. H. Pool was a recent visitor to Hibbing, Minn., where he inspected the Hull and Sellers open pits, in which he is interested.

W. H. Jefferys, mining engineer of Haileybury, Ont., has returned from Labrador, where he spent several months in prospecting.

M. M. Duncan, of Ishpeming, Mich., vice-president and general manager of the Cleveland-Cliffs Iron Co., is spending a month in California.

Edwin L. Derby, Jr., of Ishpeming, Mich., chief geologist of the Cleveland-Ciffs Iron Co., is spending a few weeks in Washington, D. C., on business for the company.

H. Kurushima, mining engineer for the An-Shan Steel Co., South Manchurian railway, has completed his visit on the Minnesota and Michigan iron ranges and has left for New York.

Ernest Harms, for many years connected with metallurgical activities in Mexico, particularly with the Torreon smelter, is now in Los Angeles as president of the Zinc Products Co.

Walter S. McKee has resigned as vice-president and director of the American Manganese Steel Co., and will develop the business of the Inland Engineering Co., of Chicago, of which he is president.

J. P. Hutchins, mining engineer, of San Francisco, has been appointed a consulting engineer on the staff of the U. S. Bureau of Mines. His first report in that capacity will be on placer mining methods in Australasia.

Stanly A. Easton, of Kellogg, Idaho, general manager of the Bunker Hill & Sullivan Mining & Concentrating Co., is hunting big game in the wilds of the Clearwater, Idaho. He expects to be absent about two weeks.

Dr. George B. Waterhouse, for the last sixteen years connected with the Lackawanna Steel Co., at Buffalo, N.Y., has accepted the appointment as head of the section of metallurgy in the department of mining, metallurgy and geology at the Massachusetts Institute of Technology, Boston, and assumed his new duties at the beginning of the present college year. Dr. Waterhouse was born on May 25, 1883, and received his early education in Great Britain. Five years of his university training were spent in England, the greater part of which was at the University of Sheffield, and in the United States he had

George B. Waterhouse

three years at Columbia University. Since 1906 he has been with the Lackawanna Steel Co. as metallographist and metallurgist, and for the last few years as metallurgical and inspecting engineer. Dr. Waterhouse succeeds **Prof. H. O. Hofman**, who resigned last June as head of the department at the Boston institution, after many years of service.

J. L. Lamson has been transferred from the U. S. Geological Survey's New England district to the New York district, with headquarters at Albany. **Harry I. Granger** was at the same time transferred from Albany to Boston.

H. C. Fink, of New York, is investigating the Indian Peninsula molybdenum property near Amos, Quebec, to ascertain whether the production of molybdenum, which was suspended after the war, can profitably be resumed.

Albert J. Walcott, a graduate of the University of Michigan, and for the last three years carrying on research work in optical glass with the Bausch & Lomb Optical Co., has been appointed lecturer in mineralogy at Northwestern University.

W. Earl Greenough, mining engineer, who has lived for many years in Wallace, Idaho, has gone to Montana, where he will give his attention to the leasing and development of oil lands. For the last year or more he was in charge of oil operations near Lander, Wyo.

Walter K. Mallette, for the last two years chief engineer of the Compañia Carbonífera de Sabinas, S. A., at Rosita, Coahuila, Mexico, has severed his connections with that company and opened offices at 13433 Euclid Avenue, Cleveland, where he will engage in independent consulting work as metallurgical and mining engineer. At present, Mr. Mallette is engaged on professional work in Mexico and the Southwest.

Raymond K. Bowden, of Niles, Ohio, has been appointed instructor in metallurgy, for 1922-23, of the Carnegie Institute of Technology at Pittsburgh. Mr. Bowden is a graduate of Ohio State University, in the class of 1920, with a bachelor's degree of engineering in mining. His practical experience covers two years as superintendent of inspection with the Central Steel Co., at Massillon, Ohio, and one year as assistant to the heat treater at the Crucible Steel Co. in Pittsburgh.

Louis D. Tracy, of Edgewood, Pa., has been appointed superintendent of the central experiment station of the Bureau of Mines at Urbana, Ill. Mr. Tracy was educated at the Sheffield Scientific School and at Yale University. He holds degrees as both mining and civil engineer. He joined the staff of the Bureau of Mines on July 15, 1918, and since that date he has served the Bureau continuously as a coal-mining engineer. Mr. Tracy takes the position made vacant by the recent resignation of **J. J. Rutledge**, who now is chief mining engineer of the Maryland Geological Survey.

Mining and metallurgical engineers visiting New York City last week included: **Carl A. Trager**, of Vera Cruz, Mexico; **John C. Anderson**, of Long Beach, Calif.; **H. M. Wilten**, of Chicago; **L. M. Cockerell**, of London; **Bernard MacDonald**, of Parral, Chihuahua, Mexico; **H. M. La Follette**, of La Follette, Tenn.; and **C. E. Rogers**, of Cobalt, Ont.

OBITUARY

Robert Anderson, aged seventy three, died recently in El Paso, Tex. Mr. Anderson was the owner of one of the oldest mines in New Mexico, the Anderson-Apache copper mine. This he located in 1883, and it has been kept in continuous operation since that time.

Emile Berthier, long connected with the mining industry of Mexico, died at his home in Mexico City on Sept. 21. Mr. Berthier was born in New Orleans, in 1864 and has made Mexico his home for the last forty years. He has at one time or another been director of the following mines: Dos Estrellas, Angustias Dolores, Garduño, and Negociación Minera de San Rafael y Anexas.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

TWO new milling plants are completed in Nevada. Candelaria cyanide plant is being tuned up, and Betty O'Neal flotation plant, at Battle Mountain, is receiving finishing touches.

Milling is resumed in Cobalt and neighboring camps, following the disastrous fires.

New wage scale may result in shutting down of various non-producing operations in Northwest states.

Probable reductions in rail rates on lead and copper bullion will stimulate ore shipments to Salt Lake Valley smelters.

Gold dredging in California is active.

Miners at Tonopah and Divide, Nev., win one-day strike and a 50c. wage increase.

Granby Consolidated has increased wages and anticipates larger production at lower cost.

Inadequate remuneration forces Dr. Stratton from U. S. Bureau of Standards.

Tintic Standard mine, in Utah, has opened new orebody on 900 level.

Construction of new concentrator at Kimberly, B. C., is progressing rapidly.

Rio Tinto Co., operating in Spain, pays first dividend since 1919.

Granby Consolidated Increases Wages—Likewise Production

Output for 1922 Estimated at 30,000,000 Lb. Copper—New Power Plant Should Lessen Cost

The 2,500 employees of the Granby Consolidated Mining & Smelting Co., operating in British Columbia, received an increase in wages on Oct. 1 of about 50c. per day. The company, it is stated, expects to produce 30,000,000 lb. of copper this year. During the first part of the year the production amounted to about 13,000,000 lb., but since the end of June operations have been speeded up. Plans have been completed for a concentrator, but the time has not yet arrived for its installation. Eventually, however, the Granby will resort to milling. The hydro-electric installation is being hurried to completion, and it is hoped that it will be ready by the end of the year. This should effect a reduction in cost of from ½ to ⅝c. per lb. of copper.

The company has taken a bond on the Outsider group, of eight claims, situated at Maple Bay, on the Portland Canal, about 35 miles from the town of Stewart. The Brown-Alaska Co., in 1905, shipped 14,500 tons of ore from the group, which assayed practically 3 per cent copper and averaged around $1 in gold and silver to a ton. The Granby Co. has recently contracted for further tunneling and exploration.

Rio Tinto Declares Dividend

By Cable from Reuters to "Engineering and Mining Journal-Press"

London, Oct. 14—Directors of the Rio Tinto Co. have declared an interim dividend on the ordinary shares of 10s. The last ordinary dividend was paid in 1919.

Tonopah Miners Get 50c. Raise After Brief Strike

Companies Offer 25c.—Walkout Follows and Compromise Reached on Oct. 16—Surface Men Get 25c.

Underground miners in the Tonopah and Divide districts in Nevada quit work on Oct. 15 after refusing a 25c. increase offered by the operators. On the 16th, an agreement was reached whereby the men returned with an increase of 50c., bringing wages to $5.75 per shift, effective Oct. 17. The settlement also included provision that surface men should be increased 25c. per shift, the additional wages to be paid retroactively from Oct. 1 instead of Oct. 17.

Early in the month the miners made a demand for an increase of 75c. per day, arguing that working conditions and comparative wage scales in other camps warranted the increase. They agreed, however, to continue at work until Oct. 15, when they would expect a definite answer from the operators. The latter felt that the demand was unreasonable and pointed to the fact that the existing scale was higher than that paid in any other large mining district in the West. They also maintained that working conditions were of the best and called attention to the excellent record with respect to accidents as compared with other districts.

On the 15th the companies made the offer of a 25c. increase, which would make wages $5.50. The miners stood on their original demand and walked out. Later a compromise was reached and the men returned on the $5.75 basis. This is the highest wage paid anywhere, with the exception of Randsburg, in Southern California, where the minimum scale for underground men is $6.

Wage Increases Hard on Non-Producing Mines

Properties Under Development in Northwest May Soon Be Forced To Shut Down

The recent raise in wages of miners in the Coeur d'Alene district, Idaho, has resulted in announcements of raises in wages in outlying districts. The Continental mine, at Port Hill, is the first to announce that it will raise the wages of its employees to the Coeur d'Alene scale. It is rumored that the Talache mines, at Talache, will also adopt the scale. As yet no word has reached here of any mines in eastern British Columbia granting raises.

The situation, however, is not agreeable to the non-producing mines. Many of these properties are not prepared to incur additional expense, and some mines will cease operations rather than meet the scale.

In the Republic (Wash.) gold mines, where production has just started after several years of enforced idleness on account of high wages and prices, miners are demanding a raise in wages. The operators maintain that their margin is so low that some of the lower-grade properties will be compelled to discontinue if they are unable to get tinental mine, at Port Hill, is the first men at the old scale. Whether they will be able to do so of course remains to be seen.

Gold Production in the Transvaal and India

By Cable from Reuters to "Engineering and Mining Journal-Press"

London, Oct. 14—The output of gold during September in the Transvaal was 747,089 oz., and in India, 32,550 oz.

Aftermath of Fire in Northern Ontario—Mills Again in Operation

Within a few days after the disastrous fire of Oct. 4 that destroyed Haileybury, Ont., and other towns in the vicinity of Cobalt, all the 8,000 homeless victims were under temporary shelter of some sort, and adequate supplies in the way of food, clothing, blankets, were being received. It has been decided to build standard cabins 18 by 20 ft. One million feet of lumber has been ordered.

The spirit of the people in the devastated areas is excellent, and where lumber is available building operations have already been started. It is expected that a large part of Haileybury will be rebuilt. Three days after the fire the banks had reopened for business in single rooms and in garages.

Power was delivered to South Lorrain on Oct. 7, and the mines there are again working. On Oct. 11 sufficient power was obtained from the Charlton plant to enable Kirkland mines to begin pumping and to provide lights for the town and the mines. The main power line from Cobalt and Matabichewan will, however, have to be repaired before the companies can start mining and milling. The work should require about a week. Recent rains have provided sufficient water in the Montreal River to supply Cobalt with power, and milling was again started on Oct. 14.

Reduction in Rail Rates for Eastbound Bullion Is Probable

Efforts to secure a reduction on freight rates for lead and copper bullion from Utah smelters to eastern points are being made by the mining committee of the Salt Lake City Commercial Club. Though no definite promise can be made at this time, executives of the railroads are said to have the matter under consideration, and it is probable that some reduction will be made.

News from Washington

By PAUL WOOTON
Special Correspondent

Miners in Alaska Lack Technical Guidance

Philip S. Smith Sees Need for Engineering Advice by Operators Developing the Mineral Resources of the Territory

THE GREATEST NEED of the great majority of those who are trying to develop the mineral resources of Alaska is technical advice, in the opinion of Philip S. Smith, administrative geologist of the U. S. Geological Survey, who has just returned after three months in the territory. Mr. Smith found a dearth of engineers and geologists available for general retainers. Whether the time is ripe for any considerable number of technical men to enter the Alaskan field, however, is debatable, in Mr. Smith's opinion. The business is there, but it must be developed, as many of those who need technical advice and assistance most are ignorant of that fact and must be "sold" on the idea.

The condition has resulted in considerable loss to some of the small operators, Mr. Smith says. He found at least three instances where mills had been erected before the mines had been developed or proven, and others indicating a too-prevalent jumping at the conclusion that every likely looking prospect necessarily will soon develop into a paying mine. Mr. Smith reports one example where a 300-ft. drift deviated 90 deg., no one having been engaged to run a line.

The future holds much for Alaska, however, in Mr. Smith's opinion. He considers that the mineral resources of the territory are only partly developed. He found increased activity in prospecting 50 to 75 miles from the railroad. Most of this is by old placer men, who are having difficulties with hard-rock mining because of lack of experience and failure to engage technical advice, and for the reason that most of whom are operating on small capital.

There is an insistent demand for branch railroad lines, but Mr. Smith points out that spur tracks cannot be built until there is traffic to sustain them. Development must precede railroad extension.

The greatest activity at present is in the Willow Creek and Hope districts, consisting mostly of the search for gold ore. In the former district, a half dozen small operators recently have combined to make a crosscut, engage experts, and otherwise effect economies, and in Mr. Smith's opinion this tendency to group small operations will increase as the better results from the practice become known. Each successful operation benefits the whole territory by giving men employment in which they can make a grubstake and gain experience, so as later to branch out as prospectors on their own account.

Recently, some rich silver ore has been found. Copper development is practically at a standstill.

Granby Consolidated plant at Anyox, B. C.

Pittman Act Silver Purchases, 136,859,576 Oz.

Purchases of silver by the Bureau of the Mint during the week ended Oct. 14 amounted to 589,000 oz. This brings the total purchases under the Pittman Act to 136,859,576 oz. The total amount to be purchased is approximately 207,000,000 oz. Estimates place the date of expiration of Pittman Act purchases at about Dec. 1, 1923.

Preliminary Report on Heat Treatment of Drill Steel

Efficiency of Mining Operations Can Be Increased by More Careful Attention in Preparing Drills

Engineers in the service of the Bureau of Mines and the Bureau of Standards have completed the draft of their report dealing with the present status of the practice of the heat treatment of drill steels and the effect of treatment on breakage. Before the report is made public it will be considered by the executive committee of the advisory board appointed by the American Institute of Mining and Metallurgical Engineers to co-operate with the Bureaus on the drill-steel work. The report is preliminary in character, and it is the intention to continue the work for another year.

Benjamin F. Tillson, the chairman of the executive committee, has requested the members of the committee to meet on Nov. 17 to discuss the report and to recommend any changes that may be thought necessary before it is presented to the Institute on Feb. 20.

The field work on this problem, which was done largely by Francis B. Foley and Charles Y. Clayton, metallurgists on the staff of the Bureau of Mines, and by Henry S. Burnholz, a metallurgist with the Bureau of Standards, indicates that greatly increased efficiency in mining operations may be obtained by disseminating more exact knowledge as to the breakage of drill steel and as to its heat treatment. The work on this problem was begun in 1919 at the Minneapolis station of the Bureau of Mines. Mr. Tillson, of the New Jersey Zinc Co., who had given much attention to the problem, conferred with representatives of the Bureau of Mines on the matter, and the result was a conference on the subject in Chicago in November, 1920. Out of this conference grew a co-operative agreement between the Bureau of Mines and the Missouri School of Mines for the prosecution of the work. In February, 1921, Mr. Tillson arranged for the discussion of the subject at the annual meeting of the American Institute of Mining and Metallurgical Engineers. During that discussion, it was suggested that an advisory committee be created to work with the Bureau of Mines and the Bureau of Standards in the further prosecution of the investigation.

During April, May, and June, Messrs. Foley, Clayton and Burnholz studied drill steel handling at sixty mines west of the Mississippi river. The results of all of the work are summed up in the report which will be considered by the executive committee on Nov. 17. The executive committee is composed as follows: B. F. Tillson, New Jersey Zinc Co.; W. H. Leonard, Denver Rock Drill Manufacturing Co.; J. A. Mathews, Crucible Steel Co. of America; Van. H. Manning, American Petroleum Institute; D. A. Lyon, Bureau of Mines, and G. K. Burgess, Bureau of Standards.

Inadequate Remuneration Forces Dr. Stratton from Government Bureau of Standards

Dr. S. W. Stratton, for twenty-one years Director of the Bureau of Standards of the Department of Commerce, has resigned to become president of the Massachusetts Institute of Technology. In connection with Dr. Stratton's resignation, Secretary Hoover issued a statement condemning the "desperately poor pay" allowed scientific and technical men by the government. He pointed out that the Massachusetts Institute of Technology, an educational institution, has no difficulty in paying men of Dr. Stratton's caliber three times the salary which the government allows them. "The inability of scientific men in the government to support themselves and their families properly under the living conditions in Washington," said Secretary Hoover in his statement, "and to make provision for old age, makes it impossible for any responsible department head to secure such men for public service at government salaries."

As Director of the Bureau Dr. Stratton built up an institution. He took over the directorship of the Bureau when it was created, in 1901. The first annual appropriation was $200,000.

From that small beginning Dr. Stratton has built up a great scientific laboratory which has been intrusted with the expenditure of more than $2,000,000 on a year's work. Under Dr. Stratton's direction, the Bureau has grown until it is the largest physical laboratory in the world, and employs more specialists in research than any other single agency in this or any other country.

Advisory Committees Will Co-operate with U. S. Bureau of Mines

At the request of the Bureau of Mines, the American Zinc Institute has appointed an advisory committee to co-operate with the Bureau in its work on the problems involved in the mining, milling, and metallurgical treatment of zinc ores. The committee is composed as follows: George O. Argall, Charles Bocking, W. E. Mitchell, William A. Ogg, Charles T. Orr, Ralph M. Roosevelt, William N. Smith, George C. Stone, F. C. Wallower, Howard I. Young.

An advisory committee to co-operate with the Bureau in its electro-metallurgical work has been appointed by the president of the American Electrochemical Society. The committee is constituted as follows: Carl G. Schluederberg, Westinghouse Electric & Manufacturing Co.; Acheson Smith, Acheson Graphite Co.; Frank W. Brooke, Electric Furnace Construction Co.; Daniel L. Crosby, Detroit Electric Furnace Co.; C. B. Gibson, Westinghouse Electric & Manufacturing Co.; John A. Seede, General Electric Co.; Robert Turnbull, U. S. Ferro Alloys Co.; F. A. J. Fitzgerald, consulting metallurgist, Niagara Falls.

War Minerals Awards Range from $65 to $4,381

Subject to the approval of the Secretary of the Interior, the War Minerals Relief Commissioner has recommended an additional award of $2,990 on the White Horse operations, at Philipsburg, Mont. The former commission awarded $468.97 in this claim. The owners of the mine, however, appealed for a rehearing and requested that they be given an additional award of $4,381.48 on account of alleged errors on the part of the former commission in computing expenses for subsistence and supplies and for expenditures on an adjoining property, the Manganese Fraction mine. These claims were allowed in part.

After an exhaustive review of the claim of the United States-Canadian Manganese Co., of Trenton, N. J., the commissioner has declined to recommend any further award. The company was awarded $17,675.58 by the former commission. It had asked for an additional award covering the purchase price of land and the mineral rights and for a rebate on the salvage value allowed by the former commission on machinery and equipment. The request was denied. Other awards have been recommended as follows:

George D. Gross, Nogales, Ariz., $665.67; Alexander Guthrie, Alderpoint, Calif., $212 (additional); Doig & Julian, Five Pines, Calif., $222.50; C. E. Connally, San Luis Obispo, Calif., $65.50; Tucker & Sartorius, San Francisco, $590; Field Bros. and Stocker, Fosteria, Calif., $960.50; I. Carpenter, Chico, Calif., $396.25; Gramps, Baker & Gramps, San Francisco, $709; B. F. Clark, Yankee Hill, Calif., $1,135.60; Goss Manganese Co., Elizabethtown, Tenn., $1,146.95; McKeen Bros., Callahan, Calif., $570.50.

The claim of Smith Bros., of Taylorville, Calif., was disallowed on the ground that no net loss is established in their contentions.

Smith Will Divide Time Between Coal Commission and Geological Survey

The appointment of Dr. George Otis Smith as a member of the President's Coal Commission makes it necessary for him to curtail his duties as director of the U. S. Geological Survey. P. S. Smith will act as director during the time that the coal commission requires the major part of Director Smith's time. Director Smith, however, expects to continue some of the work which he handled as director of the Survey. In announcing the appointment of P. S. Smith as acting director, Dr. Smith, in a Bureau notice, says: "I realize that this shifting of burdens means added work for several of my associates, but I believe that this is an opportunity to make the largest use of Survey data and personnel to the advantage of the public. On that account, I am willing to work harder myself for the next eleven months and to ask my associates to do the same."

News by Mining Districts

By Special Correspondents in the Field

London Letter

Gaika Gold Will "Write Down" Capital; Outlook Gloomy—Hampton Properties Open Ore

BY W. A. DOMAN

London, Oct. 6—The Gaika Gold Mining Co. (Rhodesia), which Stanley Edwards so dramatically captured from the Gold Fields last year, has issued its report under the new régime. From the dividend standpoint it cannot be said that the shareholders have benefited, for they receive only 7½ per cent, as against 12½ per cent. This reduced payment is rendered possible only by the price obtained for gold in excess of the standard, i.e., 12s. 4½d. per oz., in contrast with 26s. 4d. the previous year. From 48,414 tons crushed, 18,391 oz. of fine gold was recovered at an expense of 24s. 7d. per ton, or £3.23 per oz. Early in July, when A. M. Mackilligin, the manager, made his report, the reserves were estimated at 46,671 tons of "probable" ore, at 13.6 dwt., of which 30,404 tons, at 14.1 dwt., was available for stoping. Since that date, the quantity has been decreased, and the position, viewed even from the best angle, does not look too hopeful.

At various points in both the north and south sections of the mine, ore of a profitable character has been opened, though it has added nothing to the net reserves. A broad development policy is to be undertaken, and to provide the funds, the feed value is to be raised to 9½ dwt., and 4,000 tons monthly is to be milled. In the previous year's report, it was stated that the Rubble Reef appeared to be fully developed. On the fifth level, further exploratory work has disclosed what is believed to be the Rubble Reef, and the values are regarded as encouraging. Reading between the lines of the report, it would seem that the directors are not optimistic, for they foreshadow a writing down of capital during the next twelve months of 5s. per share "if a conservative policy is followed regarding dividends." Financially the company is strong, and though some of the shareholders are beginning to kick at the reduced dividend, it may be to their benefit in the long run to get a return of capital. Few companies in London have yet adopted this method of defeating the income-tax gatherer, but it would not be surprising to find it come more into vogue. It savors more of finance than of mining, and if the Gaika had remained in the hands of the Gold Fields, the mine would probably have been worked out and the company wound up in the orthodox way. Apparently there is not unanimity on the board in regard to the policy, for a further change is indicated.

The directors of the Mazapil Copper Co., to which I referred on Sept. 22, who refused to accept the offer of the Gold Fields to buy the shares at about 35s., have circularised the shareholders advising them not to sell.

I learn from Western Australia that encouraging developments have taken place on the Hampton Properties ground. On Block 45, at 100 ft., a big reef is being stripped 10 to 12 ft. wide, averaging 11 dwt., and a ten-stamp battery is being put up, with leaching plant complete. It is estimated that the management has twelve months' possible ore in sight and can pay expenses of development. From 139 to 146 ft. another lode, 10 ft. wide, was struck, averaging 10 dwt., but this could not be developed, on account of water, and a bigger pump is being installed.

Johannesburg Letter

August Gold Output Shows Increase—Fresh Discoveries Are Reported

BY JOHN WATSON

Johannesburg, Sept. 12.—During the past week the following gold-mining returns for August have been published:

	Tons Crushed	Revenue Declared, £	Working Cost per Ton s.	d.	Estimated Profit, £
City Deep	89,000	171,955	24	4	63,701
Cons. Main Reef	53,000	86,607	25	9	18,431
Crown Mines	226,600	307,653	19	8	84,865
Durban Rood. Deep	31,800	49,054	25	9	8,058
East Rand P. M.	125,000	142,503	20	11	11,553
Ferreira Deep	34,000	44,479	21	5	8,007
Geldenhuis Deep	54,650	62,220	21	4	3,977
Knight Central	32,500	29,081	16	10	1,681
Modder B	62,000	149,531	21	9	82,099
Modder East	27,000	52,507	27	8	15,159
New Modder	112,000	237,677	17	4	140,603
Nourse Mines	48,000	67,803	24	5	9,171
Robinson G. M.	18,300	27,295	17	10	11,000
Rose Deep	53,700	57,513	18	1	9,043
Wolhuter G. M.	32,100	36,048	20	8	2,903
Village Deep	57,600	81,444	22	5	16,835
Cons. Langlaagte	45,200	56,927	20	3	11,366
Government Areas	.....	.....	17	6	162,542
Langlaagte Estate	51,300	73,928	20	10	20,706
New Primrose	20,200	20,732	18	7	2,114
New Unified	11,900	11,361	17	3	1,159
Randfontein Central	157,000	209,834	19	10	55,684
Van Ryn Deep	57,200	130,126	20	6	72,001
Witwatersrand	48,000	55,925	17	8	15,074
Geduld Proprietary	46,800	76,747	19	5	31,288
Modder Deep	44,800	110,823	18	3	69,966
Aurora West	11,000	13,702	21	7	1,825
Meyer & Charlton	15,200	39,681	21	9	23,121
New Goch	17,500	17,610	18	9	1,201
Van Ryn Estate	34,900	45,600	20	10	9,220
West Rand Cons.	34,300	45,083	23	7	4,604
Brakpan	64,000	109,428	22	3	46,070
Springs	48,000	90,507	22	6	42,600
Transvaal G. M. E.	16,170	24,965	..	..	2,353
Wit. Deep	37,200	57,484	..	..	13,751
Glynn's Lydenburg	3,862	7,440	..	..	959
New Kleinfontein	47,900	53,984	20	4	5,371

The monthly output of gold for the Transvaal for August was declared on Sept. 9 by the Chamber of Mines as 752,490 fine oz., having a value of £3,461,454. This shows an increase of 21,855 oz., in value, equal to £100,533 over the figures for July. The most notable increases were from the Crown mines, 5,577 oz.; Randfontein, 4,395, and New Modder, 3,015 oz. increase. The native labor returns show an increase of 2,168 natives at work on the gold mines in August as compared with the previous month.

Finds of 788 carats of diamonds in the month of August have been declared from the farm Kaalplaats, No. 106, on the Vaal River, near Lindegue's Drift. The value of these stones amounts to £6,053. Another return from the same district showed 530½ carats, valued at £3,469, found in a period of ten days. It is expected that this farm will be "proclaimed" on Sept. 15. Fresh discoveries of gold are reported from the farm Kameelboom, No. 857, where a reef is said to be exposed in four cuttings, averaging 36 to 51 in. wide, assaying 21.10 dwts. On another government farm, Batavia, No. 858, two reefs have been opened up about 150 yd. apart, assaying 66.30 dwts. These assays are probably from individual samples and not an average of the series.

QUEENSLAND

Sardine Tin Mine Profits from Development Work

Brisbane—In the Sardine, which is now recognized as the best tin mine in Australia, another important find is reported. A government geologist, reporting on this property, on the Kangaroo Hills mineral field, North Queensland, predicted that the mine would improve as it was deepened and opened up. His opinion has been borne out by results as work has proceeded. The latest discovery is a new deposit which has been found in one of the levels, and which is 18 in. in width, having a content of 15 to 20 per cent black tin. It was, when struck, about 6 ft. in length, and at last report was still good. The last monthly crushing was sixty tons of ore for twelve tons of tin oxide. This crushing and the preceding one gave an average return of 20 per cent. The company owning the mine has just declared its twelfth dividend of 3d. per share, making a total distribution of £28,000 in two and a half years. This was the only tin mine in Australia to continue working at a profit during 1921, and its product up to the last few months has been obtained from development work only.

The only gold mine in the Cloncurry district—the Mount Quamby—has com-

pleted the erection of its mill and treatment plant, and has just reported its first crushing. The mine, which was discovered about two years ago, is a low-grade property, consisting of a huge deposit of conglomerate worked by means of open cuts and a tunnel. So cheaply can the ore be mined that the Mount Quamby company was satisfied that an average return of 5 dwt. per ton would give a good profit. The crushing now reported consisted of 125 tons, and gave a return of 51 oz. of smelted gold.

One of quite a number of tin mines in the Herberton district, North Queensland, that have of late been doing very well and giving good promise for the future, is the Lord Nolan, at Silver Valley, not far from the town of Herberton, where tin was first discovered in this region. A crushing of eighty-one tons last month from this mine yielded 9½ tons of tin concentrates.

The mine that is showing best among those opened of late on the recently revived Normanby goldfield, southwest of Bowen, is the Frederick, owned by the Billy Hughes Gold Mining Co. The reef being worked on this property was discovered in 1889, but early returns were not encouraging, and the mine was abandoned four years later. The present holders have recently cleaned out the old shaft, which was down about 50 ft., are putting a drive in the opposite direction to that of the old workings, and are sinking the shaft another lift. In the new drive, when it had been taken only 40 ft., the reef was no less than 4 ft. wide, with values of 2 oz. 4 dwt. of gold per ton, and adjoining the reef there is 1 ft. of rubbly ore returning 1 oz. A mill has been erected at the mine.

VICTORIA

Northern Territory Merits Exploration and Development

Melbourne—The employees of the Wallaroo & Moonta Mining & Smelting Co. have accepted the terms offered by the company, and operations are to be resumed forthwith. H. Lipson Hancock has retired from the position of general manager and been succeeded by William Slee, who has been associated with the company since 1895 and has recently been in charge of the smelting works.

Although the Northern Territory has been the scene of many wildcat mining enterprises, indications are not wanting that the mineral resources warrant development. The Northern Territory is the most undeveloped part of Australia. The total white population is only a few hundred, and these are mostly resident in the seaport of Darwin. Population is the first necessity, but means of transport are also required. The Commonwealth government is at present considering the question of constructing a transcontinental railway from Oodnadatta, 688 miles north of Adelaide, but there are considerable differences of opinion as to the best route. One of the Northern Territory gold fields which is attracting attention is the White Range, Arltunga, in the MacDonnell Ranges, about sixty miles from Alice Springs telegraph station and 280 miles north from Oodnadatta.

E. Copley Playford, Chief Warden of Mines in the Northern Territory, has visited the field and reports as follows: "The gold-bearing formations are most unusual, and I have seen or heard of none of a similar nature; they cannot be termed lodes or reefs, and the only expression that conveys any idea of their character is ore channels—their uniformity is very noticeable. Naturally, only the known richer places in them have been worked, but even so, should they go down, as they give every promise of doing, and retain their gold contents, the properties, when opened up in a systematic manner, will be of great value."

According to the official records at the Arltunga government battery, the output from White's blocks totaled 7,863 tons, and the value of the gold recovered by amalgamation and cyaniding the sands of tailings was £44,780, an average result of £5 18s. 6d. per ton, equal to a return of 1½ oz. of fine gold. Only the sands were cyanided, not the slimes, the recoverable value from such source being about one-fifth of the total. The best parcel from the White Range was one of 17 tons 13½ cwt. out of the Excelsior workings, which returned gold to the value of £3,548.

Some attention is also being directed to the Woolgar, another gold field in the north that has long been idle. So far, only one mine (the Perseverance) is being worked there, and this is being reopened with assistance from the government, but it is known that there are others which are worth further prospecting. The Perseverance for nine years ending 1909 yielded ore valued at nearly 1 oz. per ton. On being opened lately a crushing of sixty-nine tons gave the satisfactory return of 87 oz., with three tons of concentrates assaying over 10 oz. to the ton still to be treated.

RHODESIA

Increase in Gold and Silver Output

The British South Africa Co. announces to Reuters the following mineral output from southern Rhodesia during August. Comparative figures are given for the preceding month and also for the corresponding month last year:

	August, 1922	July, 1922	August, 1921
Gold, oz.	56,037	54,191	53,200
Silver, oz.	14,196	12,967	14,609
Coal, tons	49,465	49,973	51,088
Chrome ore, tons	973	16,803	2,676
Copper, tons	278	263	263
Asbestos, tons	1,712	1,443	1,212
Arsenic, tons	23	15	10
Mica, tons	3	4	3
Diamonds, carats	15	27	9

The number of producers is 165 and the value of the gold produced, £271,142.

ONTARIO

Cobalt Shipments Break Record—No. 7 Vein, McIntyre, Looks Good

Cobalt—During the week ended Sept. 30 shipments from Cobalt were the heaviest in years; the total was 1,593,130 lb. The Nipissing shipped ten cars of residues, containing 719,147 lb, of which two cars were shipped to a pottery firm in Berlin, Germany. The Mining Corporation shipped seven cars of residues, containing 588,390 lb. The O'Brien shipped two cars of ore, and the Coniagas and Dominion Reduction each shipped one car of concentrate.

It is understood that a large block of stock of the Lorrain Consolidated has changed hands. The property adjoins the Keeley and the Frontier, on which recent developments have been unusually satisfactory, and it is understood that it is one of these companies that is interested in acquiring control.

The Kerr Lake annual report for the year ended Aug. 31, 1922, shows net profits of $413,870, against $479,000 for the previous year. Dividends amounting to $300,000 were paid. Profit-and-loss surplus is shown at $1,228,085. The company's Cobalt property remains closed, the revenue being derived from the silver property in Utah and the dredging property in New Zealand.

Porcupine—The gold production of northern Ontario continues to increase, and during the month of September four of the mines established record productions, these being the Hollinger, Dome, McIntyre and Teck-Hughes. The total production from all the mines was over $2,000,000.

With a production of $423,000 in September, the Dome established a new high record. The average heads were $13.51, and the tonnage treated was 31,300.

Another discovery of high-grade gold ore is reported from the surface of the Paymaster property. A few weeks ago various reports emanated from the company regarding the discovery of extremely rich ore on the 300 level, and the character of the information that was given out inclined many to the belief that the company was trying to distribute stock as well as information.

Work on the No. 7 vein of the McIntyre is important. This vein is probably an extension of the Hollinger No. 84, and on the Hollinger it has already produced $15,000,000, and the last report shows $6,400,000 in reserve above the 800 level. On the 1875 level of the McIntyre this same vein has been drifted on for a distance of over 800 ft., giving an average of $20 per ton. There is still 400 ft. between the present face and the Hollinger line, and diamond drilling indicates that the ore continues. The extension has also been indicated to the east by several diamond-drill holes. McIntyre appears to be getting rapidly into a position for greatly increased production. No. 5 shaft has reached a depth of 2,100 ft. and preparations are being made in the surface equipment to provide for a depth of 5,000 ft.

Kirkland Lake—The Continental Mines, Ltd., is making a public offering of 250,000 shares at $5 per share. The company is capitalized at 700,000 shares, at $5 par, of which 620,000 have been issued. R. C. Warriner is president. The prospectus states that the average recovery from Kirkland ores to date has been $12.51 per ton, and that surface sampling and trenching on the Continental claims have given most encouraging results, with assays of $15.20 per ton. This seems to imply that a commercial orebody with an average value of $15.20 has been uncovered, but evidence is lacking that this has been proved to be the fact.

It has been decided to resume work on the Baldwin property. The company has a shaft down to a depth of 200 ft.

Lake Shore has completed the enlargement of its main shaft to the 400 level. As soon as power is again available sinking will be resumed to 800 ft., and when this is completed arrangements will be made to increase the milling capacity.

MEXICO

Southern Pacific Road to Tepic Opens Rich Mining Territory—C. C. C. Company Will Develop

Guadalajara.—The Southern Pacific R.R. has completed its line along the western coast to Tepic and will soon close the gap between that point and Guadalajara. This opens up a rich mining section. Many of the old mines, fabulously rich in gold, silver, lead, and copper, which have been closed down for several years, owing to the cost of freighting their ores from the mines to the railroads, are preparing to resume operations. Capital is now being invested in both timber and mines along the route of this road.

Cananea.—George Young, representing the C. C. C. Mining Co., has made three new locations of six pertenencias each in the Arizpe district. The locations cover a portion of the old Seguro mine which embraced a large number of mining claims in the vicinity of the Nayarit, Massey No. 2, and Bisbee properties. The new filings are recorded with the Cananea mining agent as the Chihuahua, Nayarit and Jalisco. There are a number of old workings on these properties, from nearly all of which good ore has been extracted. The shafts will be cleaned out under the direction of Mr. Young, and it is expected that by the time the titles are received sufficient ore will be blocked out to begin shipment.

The Little Eva mine has been acquired by Carl Olsen. This property comprises twenty claims, on which are several shafts and other old workings. In former operations very rich gold ore has been mined. It is understood that development will soon be started.

The Mexican Exploration Co. has taken up the Cerramento mines, in the Magdalena district, and will develop them under the direction of C. H. James. The ores from this property are of high-grade silver, with some gold.

Fresnillo—The Mexican Corporation, S. A., is purchasing additional equipment for the mill of its Fresnillo unit. When the installation of this new equipment is completed, the daily production will be increased from the present output of 3,000, to 3,500 tons. It is reported that a large shoot of a higher-grade ore has been opened.

Pachuca—The Compañía de Real del Monte y Pachuca recently increased the production of its Loreto mill, this having been accomplished by the installation of a 48-in. vertical Symons disk crusher.

Bailer Discharging, Fremont Consolidated Mine, Amador City, Calif.

Mazatlan—The Escobosa-Burns properties, held by the San Demis Mining Co. near San Demis, have been sold to San Francisco capitalists. The Butterfield property, in the Rosario district, called La Palma, has been sold to the Hearst people, who have acquired the controlling interest. Senator Clark, of Montana, is planning to start development in the near future on his huge silver blow-out, called La Bufa, in the Cosala district. A number of established mines have continued operation throughout the summer. The value of the exports from this port for the first six months of this year are shown below.

Bullion: gold, $1,094,548; silver, $1,820,574; concentrates: gold, $56,128; silver, 128,402.

CALIFORNIA

Dredging Is Active—Tonopah Capital Invested at Randsburg

Special San Francisco Correspondence

Lewiston—The Gardella gold dredge, a small, wooden-hull machine, was started on Oct. 1. The dredge will begin operations near the Paulson ranch, on the south side of Trinity River, below Lewiston. It was eighteen months in building.

The Estabrook dredge, near Carrville, is reported to have resumed operations. The Lewiston Gold Dredging Co.'s dredge below Carrville, on the Trinity River, is under construction.

Chico—At Butte Creek, three miles from Chico, the El Oro Dredging Co. is operating a 6-cu.ft. wooden dredge. The area of dredging ground is approximately 200 acres. The dredge is handling about 100,000 cu.yd. per month, and the depth of digging is averaging 18 ft.

Oroville—The American Gold Dredging Co. is operating a 6-cu.ft. dredge in the Oroville district. This dredge started operations in 1918 and is digging from 120,000 to 130,000 cu.yd. per month.

Hammonton—The Yuba Consolidated Goldfields is now operating six dredges, and the Natomas is also operating six dredges, of which two are in the Oro-

ville district and four at Natoma. The Yuba company recently placed No. 17 in operation, the equipping of this dredge with a double stacker having been completed.

Downieville—The City of Six mine was recently examined, and plans have been formulated for reopening and development on an adequate scale early next year.

Grass Valley—The Normandie-Dulmaine mine, in which Mack Sennett and other motion-picture actors are interested, may soon be placed on a producing basis. Recent equipment installed included a compressor plant of sufficient size to permit rapid shaft-sinking.

Randsburg—It is reported that the Keystone Divide Mining Co. and other Tonopah companies have acquired holdings in the Randsburg district.

MONTANA

New Corporation Will Operate Snowstorm Mine

Troy—Plans for the reorganization of the Snowstorm Mines Consolidated Co. have been perfected. The new company will be known as the Snowstorm Silver Lead Co., which will be incorporated for 2,000,000 shares, par value $1. Under reorganization plans, the stockholders of the old company will receive 156,200 shares in the new company, according to Leo Greenough, president. A new station has already been started on the No. 7 level, at which point a shaft will be sunk to sufficient depth to warrant capacity operation of the mill, which has handled 20,000 tons monthly.

COLORADO

Polar Star Will Be Operated During the Winter

Ouray—C. H. Howe and associates, of Denver, have taken over the Polar Star mine, at Mineral Point, having made first payment on the property to George E. Collins and A. B. Ponsford, of Denver. C. H. Howe has taken charge, with E. W. Creel as superintendent. All workings are being opened and cleaned out and ore is being shipped. Small quarters are being constructed this winter to serve until spring, at which time a tunnel will be driven from the Mammoth side of the hill to make available the large tonnage of milling ore already showing. Present plans are to equip the property as early as possible next spring with complete mining plant and a mill.

J. H. Ehlers and C. E. Houghton are examining the San Antonio property, at Red Mountain, and investigating a project for resuming work at this mine in conjunction with others. It is understood that the project involves new construction and operations of considerable size, to begin this fall.

Exploration at the Revenue tunnel by the Reynolds estate continues on a fairly active scale. Thomas H. Woods, superintendent of the Camp Bird, has been retained in a supervisory capacity.

NEW MEXICO

Mexican Miners Are Migrating to Arizona Copper Camps

Lordsburg—The total ore shipments from this district for the month of September amounted to 7,616 tons of copper ores and 255 tons of silver ores and concentrates. The total value was aproximately $150,000.

Schauber & Kurz, leasing on the Atwood property, shipped one car of copper ore during September and have 300 tons of ore broken for shiment to the El Paso smelter.

Fuller & Phillips have taken the Battleship ground, adjoining the 85 Mine, under lease, and will start mining operations at once.

Two carloads of high-grade copper sulphides have been shipped so far this month from the new vein recently opened in No. 1 shaft of the Bonney mine by Shollie and Reynolds, lessees. A car of copper oxides from the same shaft, but another vein, is piled on the platform ready to go forward; this ore has a gross assay value of about $50 per ton. Shipments are made to the Copper Queen smelter at Douglas, Ariz.

Numbers of Mexican laborers from old Mexico are seen daily traveling west by train and trucks, en route from El Paso to Arizona mining camps. The labor agent is once more abroad seeking men for the big copper companies.

Deming—The lead-silver ground in the Tres Hermanas formerly held by the Ramoha Mining Co., the South Trail claims owned by Manning Bros., and the Waterloo ground owned by Dr. S. S. Warren, of Mescalaro, has been optioned by California parties who intend to develop it. A small truck, two five-ton trucks, a 150-hp. gas engine and a core-drill outfit have been purchased. The formation is a quartz-porphyry carrying lead-silver sulphides. Churn drilling is now being carried on upon the Manning ground, and a drill will be started soon on the Waterloo, according to Peter Mack, who is now the manager.

Hanover—The Empire Zinc Co. has announced that it will begin mining and milling operations at its plant here as soon as a suitable force can be secured. The return of this company to active operations leaves but one large mine in this section still shut down as the result of the mining depression following the war; that is the Burro Mountain Copper mine, at Tyrone, owned by the Phelps Dodge Corporation.

Silver City—Increased ore shipments from the Houston-Thomas group of mining claims, north of Silver City, have brought the daily tonnage to between 125 and 150 tons a day. Additional trucks and teams are being used to haul the ore from the mines to the Santa Fe freight yard. Operations are being conducted by the Grant County Mining Co. B. D. Coodier is superintendent.

NEVADA

Candelaria Cyanide Plant Is Started—Betty O'Neal Mill Almost Ready

Tonopah — Bullion shipments from this district for the latter half of September were as follows: Tonopah Belmont, $93,000; West End, $75,520; Tonopah Extension, $75,000; Tonopah Mining, $46,000. Total bullion produced for the month was approximately $575,-600, which is about $50,000 below normal, the decrease being principally in Belmont shipments.

It is authentically reported that the West End Consolidated Mining Co. has purchased the entire Kearns estate interest in the Halifax Tonopah Mining Co. The latter company owns and operates the Halifax mine, in the eastern part of the Tonopah district. The Halifax is a producing mine, and important orebodies have recently been opened from the 800 and 900 levels. The main shaft is 1,700 ft. deep.

Rochester—September bullion output of the Rochester Silver Corporation was $55,241, against $45,340 for August. The September production is larger than for several months, and mine conditions are said to justify a continuance of production at this rate.

Candelaria—The 300-ton cyanide mill of the Candelaria Mines Co. was started on Oct. 2 and is being tested on reduced capacity. Everything is said to be working smoothly, and tonnage will be increased. Water supply is ample. This mill was scheduled to be finished about a month sooner, but the construction work was delayed because of shortage of labor and a fire which destroyed several company buildings.

Searchlight—A London syndicate is considering the financing of the Riverview property, on Fourth of July Mountain. W. W. Wishon has examined the property and recommends deeper development. The mine is well equipped, and a Lane slow speed mill is available for crushing the ore. C. W. Crowley is president of the present owning company.

Battle Mountain—The Betty O'Neal 100-ton flotation plant will be started about Oct. 25. It is planned to hold mill heads at about $25 per ton, which will produce concentrates valued at about $600 per ton. Values are in silver, gold, and lead. Machinery is electrically driven, with power generated by semi-Diesel engines. The mill is connected to the mine through a 2,000-ft. haulage tunnel, and a storage-battery locomotive will be used for ore transportation.

Pioche—As a consequence of a decided increase in mining activity, shipments are now averaging over 1,000 tons per week, with three producers represented. Shipments from the Combined Metals mine are expected to begin soon, and the Prince Consolidated Mining Co. will start before long to supply the Humboldt smelter, at Humboldt, Ariz., with siliceous tailings from Bullionville. A special freight rate has been granted recently on this grade of material.

UTAH

Tintic Standard Has Opened a Large Orebody on the 900 Level

Eureka—Tintic shipments for the week ended Oct. 7 amounted to 160 cars, compared with 156 cars the week preceding. Besides this, Chief Consolidated shipped 9 cars of limestone and 15 cars of road material. Shippers were: Chief Consolidated, 40 cars; Tintic Standard, 34; Grand Central, 25; Dragon, 11; Iron Blossom, 11; Eagle & Blue Bell, 10; Victoria, 9; Colorado, 7; Swansea, 3; Tintic Drain Tunnel, 2; Centennial-Eureka, 2; Bullion Beck, 1; Mammoth, 1; American Star, 1; Eureka Hill, 1; Alaska Hill, 1; Joe Bowers, 1. At the Tintic Standard the new orebody on the 900 level has been opened, 140 by 120 by 65 ft., with the limits not fully determined.

Alta—The new board of directors of the Emma Silver Mines plans to unwater this property below the Bay State tunnel level. George Watson, of the South Hecla, is president.

The Michigan-Utah has levied an assessment of 1½c. a share to help pay for the new aërial tramway, built to replace the one swept away by snowslides early in February. Ore mined from the discovery of November, 1921, at the intersection of the Harrison and Lavinia fissures has more than paid for mining operations, although the new tram line did not start running until the latter part of July.

American Fork—The American Leasing Co., operating the Bellerophon, Live Yankee, and Silver Wave properties under bond and lease, is continuing shipments from the Silver Wave strike. It is expected to send out about a car of high-grade ore weekly. Some ore is being milled.

Bingham—Shipments last week (excluding those of the Utah Copper and Utah Consolidated) amounted to 83 cars, compared with 75 cars the week preceding. Production is as follows: United States Mining, 36 cars; Utah Apex, 32; Bingham Mines, 9; Montana-Bingham, 6.

Park City—Shipments for the week ended Oct. 7 amounted to 4,289 tons, compared with 4,371 tons the week preceding. Shippers were: Ontario, 1,365 tons; Silver King Coalition, 1,075; Park-Utah, 1,017; Judge Mining & Smelting, Daly West & Daly, 832 tons.

St. George—The Bull Valley Gold Mines, owning claims in the Bull Valley district, has posted notice of a dividend of ½c. a share, payable Oct. 14. The dividend represents a payment on the purchase price under bond and lease contract for the sale of the property at the rate of 15c. a share on the outstanding stock. The property has been inactive for some time.

Alta—In regard to the litigation in progress for several years between the Wasatch Mines and the Little Cottonwood Water Co. over water rights, a verdict in favor of the water company has been rendered by Judge J. A. Iverson of the district court.

ARIZONA

Inspiration Builds New Quarters

Miami—The Inspiration Consolidated Copper Co. is building forty cottages at an average cost of $3,000 apiece. They are of frame construction, plastered exterior and interior. A school building costing approximately $70,000, which is of concrete, and a store building costing probably $35,000, also of concrete, are likewise being erected.

MICHIGAN

Bonus System Makes Good Wages for Miners—6,000 Employed

BY M. W. YOUNGS

Houghton—The annual report of the mine inspector for Houghton County shows that 4,343 men are now employed in the mines of the county, compared with 3,910 in 1921 previous to the shutdown of the majority of the mines on April 1 of that year. Including the mines in Keweenaw County—Ahmeek, Mohawk, and Seneca—the total number of men employed in the district is approximately 6,000. Compared with prewar years this is only 35 per cent of normal.

An increase in wages, retroactive to Sept. 16, has been announced by the Mohawk and Wolverine companies. Miners' wages, company account, have been increased from $3 to $3.50. The bonus system is continued in force for additional ground opened. The minimum footage is 65 ft. The bonus, which formerly was credited only when an additional 10 ft. was made, will now be paid for every additional foot drifted, up to $4.90 for 100 ft. The majority of the miners receive bonus payments.

A heavy movement of copper by boat out of this district is expected during the remainder of this month and in November. Much of this metal doubtless will be shipped east for storage, inasmuch as a saving of 10c. per hundredweight can be effected by taking advantage of the cheaper Lake freight rate.

It is practically certain that none of the Calumet & Hecla subsidiary properties now idle and smaller mines long closed will be reopened before spring. Neither the metal market nor labor conditions warrant resumption of operations, and reopening in the spring will be difficult unless labor becomes more plentiful.

Seneca has been delayed somewhat in the completion of its power plant at No. 2 Gratiot shaft, but it is expected sinking will start in the shaft early in November. The shaft has been rebuilt to the thirteenth or bottom level, and there will be no delay once the hoist is ready. It is from this end of the mine that production will start, probably in 1923. Before production can start it will be necessary to build a steel rockhouse, which work will be undertaken in the spring. It also will be necessary to make some repairs to the two heads, owned by the company, in the Lake milling plant at Point Mills.

MINNESOTA

Minnesota Steel Co. Will Blow in Another Blast Furnace—Employment for 300 Men

Marble—The contemplated stripping operations at the Danube open pit, operated by the Balkan Mining Co., a subsidiary of Pickands, Mather Co., has been awarded to A. Guthrie & Co., of St. Paul. The original stripping operations were conducted by the same company, which anticipates starting on the present work at once and continuing as long as the weather is favorable.

Chisholm—The Tod Stambaugh Iron Co. is installing at its Billings mine a Prescott-Menominee pump having a capacity of 650 gal. per minute and also a 4 x 6-in. Triplex clear-water pump of the same make.

The Kingston Mining Co. has started stripping operations at the old Marrow mine, which hereafter will be known as the Bradford mine. The present operating company has proved a good-sized orebody by new exploration, and plans to remove the greater part of it by steam-shovel methods.

The Shenango Furnace Co. has fulfilled its ore requirements for this season, with total shipments of about 400,000 tons. These shipments were made from the stockpiles at the Weeb and Shenango mines and from operations at the Weeb mine. According to present plans, no work will be conducted at the Shenango property.

Eveleth—Practically every ton of stockpile ore in the Eveleth district of the Oliver Iron Mining Co. has been shipped. This indicates the probability of capacity underground operations this winter. Shipments are still to be sent forward from the Spruce, Adams, and Leonidas open pits, but it is probable that no winter work will be done in these pits after the close of the present season.

Crosby—The Cleveland-Cliffs Iron Co. has completed the shipping of the company's stockpile at the Crosby mine. The ore was a wash product and was sent to the mine concentrator before shipment to the docks. This is the last work to be carried on at this property by the C. C. I. Co., as the lease is to be relinquished and work of dismantling and collection of all equipment is now going forward. The Crosby mine has been operated by the above named company since 1906, and consists of two open pits besides underground workings from which a total of 2,000,000 tons has been shipped.

Duluth — Announcement has been made by the Minnesota Steel Co. that another blast furnace will be blown in next week. This will provide employment for an additional 300 men, with the increase in other departments to handle the output from the new furnace.

Virginia—Ore shipments from the large Missabe Mountain open pit operated by the Oliver Iron Mining Co. are rapidly approaching the 3,000,000-ton mark.

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
12	.....	.....	.....	....	....	.....
13	13.625@13.75	33 50	34 25	6.50	6 30	6.65@6.70
14	13.50@13.75	33.50	34 00	6.50	6.30@6.35	6.75
16	13.50@13.625	33 625	34.375	6.50@6.60	6.30@6.325	6.80
17	13.50@13.625	33.625	34.375	6.50@6.60	6.30@6.325	6.80@6.85
18	13.50@13.625	34.00	34.875	6.50@6.60	6.30	6.80@6.85

*These prices correspond to the following quotations for copper delivered: Oct. 13th, 13.875@14c.; 14th, 13.75@14c.; 16th, 17th and 18th, 13.75@13.875c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Federal bureaus in Washington which are interested in the mining industries.

London

Oct.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
12	62½	62¾	70½	166½	167½	25⅛	24⅞	32⅝	32¼
13	62⅝	63¼	71	167⅝	168⅝	25⅛	24¼	33⅛	32½
16	62⅝	63¼	71	168¼	170	25⅜	24⅜	33¾	32⅝
17	62½	63⅛	71	169⅜	170½	25⅜	24⅜	34¼	33⅛
18	62¼	62¾	70½	171	171¾	25¼	24¼	34⅜	33⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Oct.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
12	.....	....	....	34⅜	16	4.43⅜	99¼	67¼	34 1/16
13	4.43⅛	99¼	67⅞	34⅜	17	4.43 9/16	99¼	66¾	33⅞
14	4.43⅛	99¼	67⅞	34⅜	18	4.46¾	99¼	68⅛	34¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Oct. 18, 1922

The metal markets have been quiet this week. Zinc and tin have registered advances, although buying has not been on an extensive scale. Copper is softer. Thursday was Columbus Day, and virtually no business was transacted in the New York market.

Copper

Some of the larger producers are continuing to quote 14c. delivered, but little if any business has been done on this basis since last Saturday. Others are meeting the competition of those producers whose policy provides for marketing steadily their current output. In the last three or four days the price of 13¾c. delivered has been so common that it has been necessary to go even below this to attract purchasers, and several orders of fairly large size have been placed at 13.75c. delivered. The amount of copper to be obtained at this price shows indications of being limited, however, and consumers generally are finding it difficult to obtain copper for less than 13¾c.

The decline in price is entirely attributed to the apathy of consumers. They are operating their plants to capacity, so some other reason must be assigned for the sudden lull in demand. Possibly the chief reason is the freight embargo. Whereas it ordinarily may take one week to ship from refinery to consumers' destination, it now takes three or four weeks, and the consumer is more interested in getting material in and out of his plant just now than in buying more raw materials. He has not forgotten the 1920 tie-up. The freight situation is expected to show material improvement in six weeks. Other causes assigned for the slump are the Jewish holidays last week, the "World's Series" baseball games, the climax in the Near East, which was expected adversely to affect export business in copper, and the general unsatisfactory state of European affairs; and last, but not least, the trade-paper reports that copper was softer. Reports of weakness immediately scare away buyers, who stand off and wait for the weakness to develop to its fullest extent before coming into the market. It is significant that some of the principal consumers have been buying fairly heavily on the decline.

Export business continues quiet at prices which net producers not far from those realized on domestic business.

Lead

The official contract price of the American Smelting & Refining Co. continues at 6.50c., New York.

Sales have not been so large as last week, but producers have little lead to offer, and there has been no sign of a slump in price. Lead for prompt delivery is virtually unobtainable in the New York market except in small quantities from dealers who are asking up to 6.75c. for it. With the St. Louis market firm at 6.30c., shipment from there could not be arranged under 6.65c., New York, so a slight premium on the Smelting company's price is not unreasonable. There was some effort in St. Louis to obtain 6.35c. for lead, but consumers were not particularly attracted by this price and the basis of actual business has gradually returned to 6.30c. Embargoes are affecting the lead market, being troublesome alike to producers and consumers.

Zinc

That the reaction in zinc which occurred up to the present week was merely of a temporary character is indicated by the advance in price which took place this week and which enabled the metal to recover nearly all the ground it had lost. Today common grades of zinc are being held generally at 6.85c., East St. Louis, and the market is strong. The excellent position of the metal is shown by the statistics of the American Zinc Institute for September, which state that stocks on hand Sept. 1 were 21,629 tons; production in September, 33,134; shipments, 35,957; stock on hand, Sept. 30, 18,806, or about two weeks' supply of metal. Inquiries during the week were good, and zinc

is being heavily consumed by both galvanizers and brass manufacturers. The market for high-grade metal has been highly satisfactory at prices ranging from 7.50c. to 7.75c. per lb. with 0.30c. freight allowance. For high-grade for November shipment 8c. per lb. is being asked.

Tin

The price of tin continues to advance, the rise in price being engineered entirely by London interests, and not being caused by any dearth of supplies or by improved demand. Possibly they feel that tin-platers in this country will soon decide on prices for the first half of 1923 and that the opportunity of giving the market a strong tone should not be lost. Business here has been largely between dealers, who have been content to take profits even if they sell somewhat below London parity. Straits tin for forward delivery has been quoted at discounts of ⅛ to ¼c. from the prices asked for spot. Chinese tin for forward delivery has sold for as much as ¾c. under the spot quotation.

Arrivals of tin, in long tons: Oct. 10th, China, 3; 13th, London, 25; 16th, China, 125; Australia, 18. Total this month to date, 3,616.

Gold

Gold in London: Oct. 12th, 93s.; 13th, 93s.; 16th, 92s. 10d.; 17th, 92s. 10d.; 18th, 92s. 5d.

The circulation statement of the U. S. Treasury Department for Oct. 1 is as follows: Gold coin and bullion, $3,874,178,711; standard silver dollars, $402,754,404; subsidiary silver, $270,772,004; United States notes, $346 681,016; Federal Reserve notes, $2,668,880,610; Federal Reserve Bank notes, $64,219,400; National Bank notes, $760,751,197; total, $8,388,237,342. Circulation per capita, $41.04.

Foreign Exchange

Foreign exchanges are generally stronger. On Tuesday, Oct. 17, francs were 7.53c.; lire, 4.235c.; marks, 0.03 9/16c.; and Canadian dollars, ⅛ per cent premium.

Silver

Due to further sales from China and the Continent, the London market continued to drop until Oct. 18, when buying orders from China and the Indian bazaars caused sudden recovery to 34¼d. The price in London was reflected in the New York market, and the improvement in sterling exchange, coinciding with the London advance, caused a raise of 1⅜c. locally.

Mexican Dollars—Oct. 13th, 51⅞; 14th, 51⅞; 16th, 51⅜; 17th, 51; 18th, 52c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—Importers are not anxious sellers, preferring to wait for better prices. General market for 99 per cent grade, about 20@21c. per lb.

Antimony — Chinese and Japanese brands, 6¾@7c.; W. C. C., 7.25@7.50c. Cookson's "C" grade, spot, 9c. Dull.

Bismuth—$2.35@$2.45 per lb.

Cadmium—Quiet at $1.15 per lb.

Iridium—$275@$300 per oz. Nominal.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 32@34c. per lb.

Osmium — Pure, $60@$70 per oz. troy, in Los Angeles. Strong.

Palladium—$55 per oz.

Platinum—$108 per oz. Easier.

Quicksilver—$73 per 75-lb. flask. Market firm. San Francisco wires $70.80.

Selenium—$1.80@$1.90 per lb.

Tellurium—$1.75 per lb.

Tungsten—Powder, 75c.@$1.05 per lb.

The prices of Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, and Thallium are unchanged from prices given Oct. 7.

Metallic Ores

Chrome Ore—Indian chrome ore, $18 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, $23 and $25 per ton. Market quiet.

Manganese Ore—30c. per long ton unit, seaport, plus duty; equivalent to about 45c. Chemical ore, $70@$75 per gross ton.

Molybdenum Ore—55@60c. per lb. of MoS_2 for 85 per cent MoS_2 concentrates, plus duty; equivalent to 80@85c. per lb.

Tungsten Ore—Chinese ore, $7.50@$8 per long ton unit of WO_3.

Iron Ore, Magnetite, Tantalum, Titanium, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published Oct. 7.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 14.—Zinc blende, per ton, high, $42.70; basis 60 per cent zinc, premium, $41@$42; Prime Western, $38@$40; fines and slimes, $38@$36; average settling price, all grades of blende, $38.84.

Lead, high, $86.40; basis 80 per cent lead, $85; average settling price, all grades of lead, $83.75 per ton.

Shipments for the week: Blende, 7,143; lead, 1,890 tons. Value, all ores the week, $435,720.

Purchases for the week were 4,600 tons over those of the previous week, and quotations were unchanged at the close, though a strong effort was made up to Friday evening to force prices to a $39 and $38 basis, Prime Western. One purchasing agency, out of the market the previous week, purchased more than 4,000 tons; another increased its purchases by more than 700 tons, and one other, 500 tons. Some buyers, adhering to a lower basis, failed to fill orders.

The Zinc Institute has organized to make a concerted effort to clear up the car situation.

Platteville, Wis., Oct. 14.—Blende, basis 60 per cent zinc, $44.25 per ton. Lead, basis 80 per cent lead, $90 per ton. Shipments for the week: Blende, 606; lead ore, 40 tons. Shipments for the year: Blende, 15,710; lead, 1,324 tons. Shipped during the week to separating plants, 918 tons blende.

Non-Metallic Minerals

Borax—5¾@6c. per lb.

Asbestos, Barytes, Bauxite, Chalk, China Clay, Emery, Feldspar, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, Sulphur, and Talc are unchanged from the prices published Oct. 7.

Mineral Products

Arsenious Oxide (white arsenic)—firm at 10½c. per lb.

Copper Sulphate—Large crystals, 5.85c. per lb.; small, 5.75c.

Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.

Potassium Sulphate and Sodium Sulphate are unchanged from quotations of Oct. 7.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $69@$75 per gross ton, f.o.b., furnace. Spiegeleisen, 19@21 per cent, $39, f.o.b. furnace; 16@19 per cent, $38.

Ferrotungsten—Domestic, 70@80 per cent W, 75c.@$1 per lb. of contained W, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferro-uranium, and Ferrovanadium are unchanged from the prices published Oct. 7.

Metal Products

Zinc Sheets—$8.50 per 100 lb., f.o.b. works.

Copper Sheets, Lead Sheets, Nickel Silver, and Yellow Metal are unchanged from the prices published Oct. 7.

Refractories

Bauxite brick—$45@$50 per net ton, f.o.b. shipping point.

Chrome Brick, Chrome Cement, Magnesite Brick, Magnesite Cement, Silica Brick and Zirkite are unchanged from the prices published Oct. 7.

The Iron Trade

Pittsburgh, Oct. 17, 1922

Some buyers of steel probably have stocks of considerable size, and liquidation will probably be a factor in making the steel market in the next few months. The Steel Corporation has a well filled order book, but some of the independents have little tonnage ahead.

Steel prices are firm, with delivery premiums still ruling in a few commodities. Buyers expect prices to decline.

Pig Iron—Pig iron is being offered at lower prices, which do not seem to interest buyers, and an extensive readjustment is likely. Latest sales and quotations have been at the following prices: Bessemer, $33; basic, $30; foundry, $32, f.o.b. Valley furnaces. The trade is discussing how far prices will decline before buyers take hold.

Connellsville Coke — The market began its break a week ago, and, with the market's usual sensitiveness, prices are tumbling rapidly. Last offers are at $9 for furnace coke and $12 for foundry, with buyers very reserved.

German Metal Industries Chaotic

SPECIAL FOREIGN CORRESPONDENCE

EXCHANGE DIFFICULTIES, credit restrictions, money and fuel scarcity are hampering the extension of metal business in Germany. The selling of American copper has fallen off, and the numerous copper and brass sheet, wire and tube rolling mills are preparing amalgamations or at least some sort of interest pooling in order to be able to buy copper on a larger and more efficient basis. The near future will witness certain radical changes in the commercial relations between consumers and brokers.

As for the big electrical concerns, such as Allgemeine Elektrizitats-Gesellschaft, Siemens-Schuckert-Werke, Bergmann Elektrizitats-Werke and their affiliated firms, which are yet well booked with foreign orders, it may be pointed out that they can manage to secure metals even at the present rate of exchange. They have had the chance, moreover, to acquire copper, tin, and also lead and alloys at more favorable rates by covering, at the date of purchase, their future currency obligations, but the industrial establishments of the country are unwilling to carry too great a supply of commodities because of the general uncertainty concerning future political and economic developments.

Over the heads of German captains of industry looms the sword of Damocles, and business here goes on largely on speculative lines, especially on the metal exchanges of Hamburg and Berlin. Because cash has become rare, the people of Germany buy futures. Future delivery is much dearer, therefore, than spot, as the demand for futures is larger. Furthermore, future buying necessitates foreign exchange obligations and loan interests at nearly 50 per cent. In view of the prohibitive character of such interest rates, the people purchase bullion instead of foreign currency.

In other directions people shrink from commitments even as regards spelter or lead. At the moment about 8,000 metric tons of spelter are held by the galvanizing concerns of Rhineland-Westphalia, which, however, the owners are not willing to draw upon, for this asset is looked upon as a sort of last reserve for an emergency. Since the Upper Silesian zinc mines no longer are at the disposal of the German zinc syndicate, the spelter scarcity has become more and more stringent. Recently the German industrial magnate, Mr. Stinnes, entered into a big contract, under the terms of which German firms are to deliver to France tremendous quantities of building material, which include galvanized sheets. But where shall these sheets come from if there is not enough spelter in the mills? Unluckily, one learns here that American spelter production is not large enough to allow any extensive export to the European Continent, and it is a long way to an alteration of the Australian attitude toward Germany—i.e., to the raising of its export embargo.

British spelter production is somewhat negligible and that of Belgium is mainly rolled and forwarded to France, whereas the smelting and refining capacity of Germany is believed here to be capable of expansion. As a matter of fact, the refineries of western Germany are working old spelter material and ashes to the extent of half their capacity. Manufacturers of fine spelter—this article has good export opportunities at the moment—are competing, however, with the spelter refineries for old material.

A remarkable feature has been the news that German copper refineries (that of Hirsch at Hamburg and the Norddeutsche Affinerie at Hamburg) have succeeded in manufacturing electrolytic wire bars. Therefrom expectations for future independence of Germany, in this line of copper supply, from the United States' producers, are cherished in some circles in Germany. So far, however, the American electrolytic copper has remained the standard of value in the whole German metal business. One wonders to hear that this may become otherwise in some distant future, but even clever people, when despondent, become childish. An example was afforded recently by the exuberant joy over the arrival of a consignment of old metal from Russia.

THE METAL SUPPLY DURING THE WAR

It is common knowledge that Germany was by far the biggest metal consumer of all European countries in prewar times, but as a producer she had only zinc and lead in reasonable supplies to rely upon. Immediately before the war began, Germany was a consumer of 26 per cent of the world's copper production, of about 20 per cent of that of tin and lead, of 23 per cent of zinc, and absorbed, also, increasing proportions of nickel, silver, antimony and tungsten. Germany owed the leading position of her electrical and steel trades to available facilities for receiving tremendous quantities of copper, nickel, chromium, vanadium and other metals from producing countries but as soon as the blockade cut Germany from all overseas supplies, particularly of Australian zinc concentrates, Mexican lead, Canadian nickel, and Bolivian tin and tungsten ores, the country was faced with a rapid depletion of her last reserves of available metals. The annual Mansfeld copper output, added to that of smaller concerns, amounted to only 24,000 metric tons—only 8 per cent of the normal requirement. The aluminum production, 1,200 tons, was negligible. At the storehouses of Hamburg and Bremen the total copper supplies (at the time the war began) were several thousands of tons, and the reserve of this metal in the hands of 500 principal users was 40,000 tons. Unluckily for Germany, she had also to supply Austria and her Balkan allies with ever-increasing quantities of metal.

To avert a collapse that was sure to come by virtue of an absolute lack of metals, the State War Department resorted to hard measures and forbade at first the use of virgin and half-finished metals for other than war purposes. Then an embargo was laid upon metallic articles, even kitchen utensils and household commodities. In May, 1915, the department required 90,000 tons of copper and copper alloys which were held by 40,000 German metal firms, and 4,000 tons of aluminum, 1,059 tons of tungsten, 5,000 tons of chromium, 3,000 tons of nickel and 4,500 tons of tin. There was a chance, of which advantage was taken, to obtain about fifteen tons of tin from a Saxon mine, and nearly a hundred tons of pure nickel monthly from the Frankenstein mine, belonging to the Krupp concern.

At the outset all that registering work of the War Department was skillfully organized and administered by Walter Rathenau, the lately murdered minister of foreign affairs, but he was soon replaced by a big organizer, Colonel Koeth, who by genius and military stress succeeded in requisitioning huge masses of metals of every description from every part of the country. As soon as Serbia was conquered, German engineers exploited the Bor copper mine to the extent of 18,000 tons of ore, or 1,000 tons of pure copper monthly. Large deposits of chromium ore were found in Hungaria and Serbia and treated by German smelters. The wonderfully rich deposits of Asia Minor could not be turned into account by Germany, owing to the masterly procrastinating policy of the Turks. But the feverish activity of the big German mining concerns, such as Giesches' Erben (zinc), Friedrichshütte and Rhein-Nassu (lead), as well as of the refiners that assisted the government in procuring large supplies of the sorely needed metals, made up in a satisfactory degree for the deficiencies of the Allies. A growing stream of scrap and slags from ancient dumps went into the German refineries. Not even lightning conductors, fireboxes of locomotives, or the bronze clocks of the churches were spared.

As soon as the so-called Hindenburg program was put into effect, by which nearly unlimited proportions of ammunition of every description were to be turned out, requisitioning went on on an unheard of scale. At the same time the rare metals were gradually superseded by zinc, lead, iron, and aluminum. No longer did cartridge cases consist of electrolytic copper and fine spelter, but of mere iron. Bullets of shrapnel were not made of lead and antimony, but of steel. Babbitt metals were made of calcium and barium alloys instead of tin and antimony. For solder purposes cadmium had to be used in place of tin; for steel-hardening, molybdenum and vanadium were replacing tungsten. To segregate the formidable quantities of existing "spare" metals (Sparmetalle) from their numerous alloys, extensive refinery establishments were erected. The electrolytic refineries at Ilsenburg (Hirsch), at Lünen (Westphalia), at Velten, at Eveking, and at Mülheim started in the later stages of the Great War, and the then relatively small establishment of Norddeutsche Affinerie, at Hamburg, experienced that great enlargement which gave it the efficiency which it possesses today. Much the same may be said about the Linnhütte Wilhelmsburg (near Hamburg), which during the war was busy recovering tin out of tin plate and bronze. Of high standing, down to the present day, were the plants at Call and Duisburg.

The stimulus given by the strain and stress of war time to the metal industries of Germany by the increasing scientific research and technical skill is bound to render the refining and alloying industry most efficient as soon as fuel can be obtained and exchange uncertainties adjusted.

Present Conditions in Basic Industries in the United States

AT THE National Conference of Business Paper Editors, held last week at the Hotel Astor in New York City, several short papers were read by the editors of journals representing the principal basic industries, the aim being to give word pictures of the industrial condition of the country.

In discussing the metal-mining industries, J. E. Spurr, editor of the *Engineering and Mining Journal-Press*, said:

"The metal-mining industries in general are experiencing the same impetus toward greater prosperity that the other industries of the country have been feeling. An increased consumption has led to a reduction of the stocks of the metals, and to the opening up of many of the mines that had been partially or entirely shut down on account of the lack of a demand for the metals. The greatest copper mines of the United States—the great low-grade ores commonly called porphyry coppers—most of which were closed down, have all reopened and are working at various capacities; and are showing on the average a slight operating profit. Lead and zinc have experienced a similar revival. Nevertheless, there is in the non-ferrous metal industries nothing that approaches the proportions, or even the indications, of a boom. Labor is very scarce, with the result that voluntary wage increases to miners have been made throughout the country, and this tends to offset the profit derived from somewhat higher metal prices and increased domestic consumption. Transportation difficulties—the lack of sufficient cars—have also interfered with production from some of the mining districts."

Mr. Spurr then mentioned the Pittman Act and its relation to the silver market.

In looking to the future, he made the following comment:

"The great test of prosperity for the mining industries during the next year will depend upon how far the United States is self-sufficient. Undoubtedly it is a world in itself—undoubtedly it constitutes more of a commercial closed circle than has ever been seen before within single national boundaries. How far will our own consumption take care of our own production of the non-ferrous metals? And in this consideration the present tariff policy of the United States is the chief factor. Since its effect is to raise prices and wages—prices and wages which in many cases have already risen since the passing of the tariff, as if on the touch of an electric button—it is evident that the only theory of the tariff—if there ever was an intelligent theory—is that the domestic consumption is sufficient to take care of production. Certainly the consequent increase in the cost of production cripples our chance to sell cheaply in competition in foreign markets. Then, of course, there is the universally pointed out factor that by shutting out foreign goods from our markets we prevent foreign purchases on account of the lack of wherewithal to buy our products. This applies especially to some of the great non-ferrous metal industries."

The Railroad Situation

The mining industries are particularly dependent on transportation, and some of the comments of Samuel O. Dunn, editor of *Railway Age*, are therefore of especial interest:

"By long odds the most outstanding feature of the present railway situation is the inability of the railroads to move the freight being offered to them. . . . Every single industry in the country is reporting that its shipments, and many that their production, are being restricted by lack of transportation.

"I wish I could assure you that this situation is due to temporary conditions and that it will soon be improved. I cannot do so. The coal strike has created an abnormal demand for the transportation of coal. The railway shop employees' strike has left all the railways somewhat crippled and some badly crippled.

"But the fact is, that although the coal strike and the shop employees' strike have aggravated the present transportation situation, they have not created it. It is mainly due to two series of developments. The first of these is the very large increase within recent months in industrial and commercial activity, and, in consequence, in the freight offered to the railways for movement. The second is the long decline which has occurred in the expansion of the railroads.

"It was long predicted by those who opposed the policy of restrictive railway regulation that in time it would result in making railroad transportation the limiting factor in production and commerce in this country. That prediction, unfortunately for everybody, has now been completely fulfilled. Almost every other condition is favorable to an increase of production and a revival of prosperity such as we had after the panic of 1893, after the panic of 1907, and after the depression of 1914 and 1915. The railroad situation makes impossible for the present any such increases of production and commerce as occurred then.

"Do not in this crisis denounce the managements of the railroads. The farmers and business men and the regulating authorities who have done what the farmers and business men have demanded are the people who are responsible. There is no immediate remedy for the present transportation situation. It must be borne as best it can. It can be remedied in time by the adoption of a wiser and fairer policy which will let the railways earn the net returns they require in order to furnish adequate service."

The Iron and Steel Industry

A. I. Findley, editor of *The Iron Age*, discussed the condition of the iron and steel industry and showed how it depended upon adequate transportation for prosperity:

"Iron and steel production today is largely a function of car supply. Transportation is not yet untangled from the coal and railroad strikes and is not likely to be for some time. The coal strike at its worst brought the industry down below a 50 per cent operation. The recovery was rapid in September, and today, with all the hamperings of car scarcity, the output rate is something over 70 per cent of capacity. With more than three-fourths of the year gone, we are able to estimate the total production for 1922. It promises to be around 32,000,000 tons of steel ingots as against something over 19,000,000 tons last year. We called 1921 a 40 per cent year. We are safe in putting down 1922 as a 60 to 65 per cent year. The railroads and building have been the main props of the steel industry this year."

In discussing prices, Mr. Findley said that costs are so high that producers have had small profits during 1922, with many independent companies showing "red-ink" balances for the first three-quarters of the year. As to labor, he said, "Not only has iron and steel works labor been advanced 20 per cent, but the industry is suffering from a shortage of common labor from which no relief is in sight.

"Labor supply, fuel supply, and car supply will continue to limit the industry. Prices are not likely to change materially in the next four or five months. Pig iron, having advanced so much, will show more decline than finished material as the industry works out from its fuel and railroad hampering."

Industrial Chemicals and Shipping

William Haynes, publisher of *Drug and Chemical Markets*, told of the overproduction and depressed prices of industrial chemicals in the last two years and of the ill effects of the numerous strikes in other industries. Demand is improving greatly, however, and the industry is sound. Recent changes in selling methods, consisting in marketing branded goods and announcing fixed prices, are the most significant development.

In discussing the marine industry, R. V. Sawhill, editor of *Marine Review*, said that surface indications do not give a true picture of the situation. "The troublesome liquor issue, the delay in solving the subsidy question, the eager competition for freight business at low rates, the slight amount of ship construction," are disappointing, but "fundamentally American shipowners and shipbuilders have one solid basis for encouragement"—viz., that America must become a great exporting nation. A physical fleet is in her possession, and better trained shipping and shipbuilding organizations than she has ever before had assure a return of marine prosperity.

MINING STOCKS

Week Ended Oct. 14, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	61	61	61	Aug. '22, Q	$1.00
Alaska-Br. Col.	N. Y. Curb	2⅛	2⅛	2⅛		
Allouez	Boston	23	23	23	Mar. '19	1.00
Anaconda	New York	52⅞	51½	51½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3	2⅞	2⅞		
Ariz. Com'l	Boston	8	7⅞	8	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*10	*9	*10		
Bingham Mines	Boston	18⅛	18	18	Sept. '19, Q	0.25
Calumet & Arizona	Boston	61½	60	60	Sept. '22, Q	0.50
Calumet & Hecla	Boston	285	280	284	Aug. '22, Q	5.00
Canada Copper	N. Y. Curb	*3	*1	*1		
Centennial	Boston	9	9	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	40⅜	39½	39⅞	Mar. '21, Q	0.50
Chile Copper	New York	26⅛	25⅝	25⅛		
Chino	New York	29⅜	28⅝	28⅞	Sept. '20, Q	0.37
Copper Range	Boston	40⅜	39½	39⅜	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1⅜	1⅜	1⅜		
Davis-Daly	Boston	4⅛	4⅛	4 1/16	Mar. '20, Q	0.25
East Butte	Boston	10¼	9⅜	9⅜	Dec. '19, A	0.50
First National	Boston Curb	*50	*50	*50	Feb. '19, SA	0.15
Franklin	Boston	2	1¾	1¾		
Gadsden Copper	Boston Curb	†*85	†*75	*75		
Granby Consol.	New York	31⅛	31	31⅛	May '19, Q	1.25
Greene-Cananea	New York	30⅛	30	30	Nov. '20, Q	0.50
Hancock	Boston	†2⅛	†2⅛	2		
Howe Sound	N. Y. Curb	3 3/16	3	3 3/16	Jan. '21, Q	0.05
Inspiration Consol.	New York	39¼	38⅜	38⅜	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7	6½	6½	Sept. '20, K	0.25
Isle Royale	Boston	22½	22	22	Aug. 22,	0.50
Kennecott	New York	35	33⅝	34½	Dec. '20, Q	0.50
Keweenaw	Boston	2	1⅝	2		
Lake Copper	Boston	4	4	4		
Magma Copper	N. Y. Curb			34	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	1⅜	1⅛	1 5/16		
Mass Consolidated	Boston	3⅛	2⅛	2⅛	Nov. '17, Q	1.00
Miami Copper	New York	29	28	28⅛	Aug. '22 Q	0.50
Michigan	Boston	3	2⅞	2⅞		
Mohawk	Boston	60⅛	58⅞	59	July '22, Q	1.00
Mother Lode Coa	N. Y. Curb			11	June '22, I	0.50
Nevada Consol.	New York	16⅞	15⅝	15⅞	Sept. '20, Q	0.25
New Cornelia	Boston	18⅛	17⅞	17⅞	Aug. '22, K	0.25
North Butte	Boston	11	10⅛	10⅛	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*34	*29	*32		
Old Dominion	Boston	23	22	22	Dec. '18, Q	1.00
Osceola	Boston	33	32	32	Aug. '22, Q	1.00
Phelps Dodge	Open Mar.	†175	†165		Oct. '22, Q	1.00
Quincy	Boston	40⅛	39	39⅛	Mar. '20, Q	1.00
Ray Consolidated	New York	15⅜	14⅛	14⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	1⅞	1⅞	1⅞		
St. Mary's Min. Ld.	Boston	†45	†44	45	Apr. '22, K	2.00
Seneca Copper	Boston	7¼	7¼	7¼		
Shannon	Boston	*70	*70	*70	Nov. '17, Q	0.25
Shattuck Arizona	New York	†9⅛	†8⅛	9⅛	Jan. '20, Q	0.25
South Lake	Boston	†1	†*50	*35		
Superior & Boston	Boston	1⅛	1	1		
Tenn. C. & C. cfs	New York	10	9⅜	9⅞	May '18, I	1.00
Tuolumne	Boston	†*60	†*50	*52	May '13,	0.10
United Verde Ex.	Boston Curb	29¼	28	28	Aug. '22, Q	0.25
Utah Consol.	Boston	2⅛	2	2⅛	Sept. '18,	0.25
Utah Copper	New York	67⅛	66	66⅛	Sept. '22, Q	0.50
Utah Metal & T.	Boston	1 3/16	1 1/16	1 1/16	Dec. '17,	0.30
Victoria	Boston	1⅛	1⅛	1⅛		
Winona	Boston	⅞	1⅛	1⅛		
Wolverine	Boston	9	9	9		
NICKEL-COPPER						
Internat. Nickel	New York	17	16⅛	16⅛	Mar. '19,	0.50
Internat. Nickel, pfd	New York	82	82	82	Aug 22, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	6⅛	5⅞	5⅞		
National Lead	New York	114⅞	108	113⅛	Sept. '22, Q	1.50
National Lead, pfd	New York	116⅛	114½	116⅛	Sept. '22 Q	1.75
St. Joseph Lead	New York	19⅛	18⅞	19	Sept. '22 Q	0.25
QUICKSILVER						
New Idria	Boston	*50	*30	*30		
ZINC						
Am. Z. L. & S.	New York	19½	18⅛	18¼	May '20,	1.00
Am. Z. L. & S. pfd	New York	56	52¼	53	Nov. '20, Q	1.50
Butte C. & Z.	New York	7⅛	7⅛	7⅛	June '18,	0.50
Butte & Superior	New York	34⅜	33	33⅛	Sept. '20,	1.25
Callahan Zn-Ld	New York	9⅜	8⅜	8⅜	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	169	165	168⅜	Aug. '22, Q	2.00
Yellow Pine	Los Angeles	*65	*65	*65	Sept. '20, Q	0.03
SILVER						
Batopilas Mining	New York	⅞	⅜	⅜	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*34	*32	*33	May '20, K	0.03
Coniagas	Toronto	1.75	1.60	1.70	May '21, Q	0.12½
Crown Reserve	Toronto	*28⅛	*27	*27½	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3⅛	3⅛	3⅛	July '22, Q	0.12½
La Rose	Toronto	*25½	*25⅝	*25⅝	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*28	*25	*26	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1	*85	1	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6	5⅞	6	July '22, Q, X	0.30
Ontario Silver	New York	7⅛	7	7⅛	Jan. '19, Q	0.50
Temiskaming	Toronto	*40	*34	*37	Jan. '20, K	0.04
Trethewey	Toronto	*5¼	*4⅞	*5	Jan. '19,	0.05

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛		
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Atlas	Toronto	*33	*29	*31		
Carson Hill	Boston	8	7⅛	7⅛		
Cresson Consol. G.	N. Y. Curb	2⅜	2	2⅛	Oct. '22 Q.	0.10
Dome Mines	New York	39⅜	37⅛	38½	July '22, Q	.50
Golden Cycle	Colo. Springs	*91	*91	*91	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb			*7	Dec. '19,	0.05
Hollinger Consol.	Toronto	13.20	12.75	13.00	Oct. '22,	0.05
Homestake Mining	New York	71¼	70½	71½	Sept. '22, M	0.25
Keora	Toronto	*12	*10½	*11		
Kirkland Lake	Toronto	*45	*41½	*42		
Lake Shore	Toronto	2.90	2.64	2.88	Aug. '22, Q	0.02
McIntyre-Porcupine	Toronto	18.30	17.25	18.25	Sept. '22, K	0.25
Porcupine Crown	Toronto	*24½	*23	*24	July '17,	0.03
Portland	Colo. Springs	†*40	†*35	*40	Oct. '20, Q	0.01
Schumacher	Toronto	*57	*56	*56½		
Teck Hughes	Toronto	*90	*84½	*88½		
Tom Reed	Los Angeles	*85	*85	*85	Dec. '19,	0.02
United Eastern	N. Y. Curb	1¼	1⅛	1 1/16	July '22, Q	0.15
Vindicator Consol.	Colo. Springs	†*5	†*3	*4	Jan. '20, Q	0.01
Vipond Cons.	Toronto	*71	*63	*68		
White Caps Mining	N. Y. Curb	*14	*14	*14		
Wright-Hargreaves	Toronto	3.40	3.20	3.30	Oct. '22,	0.05
Yukon Gold	N. Y. Curb			*90	June '18,	0.02½
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*14	*11	*12		
Cons. Virginia	San Francisco	*16½	*15½	*15½		
Dolores Esperanza	N. Y. Curb	2¼	2	2⅛	Oct. '22	2.50
El Salvador	N. Y. Curb	*16	*8	*11		
MacNamara M.&M.	N. Y. Curb	*9	*7	*9	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1¾	1⅝	1⅝	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*82	*70	*70		
Tonopah Extension	N. Y. Curb	3 7/16	2⅞	3⅛	Oct. '22, Q	0.05
Tonopah Mining	N. Y. Curb	2⅛	2⅛	2⅛	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1 3/16	1⅛	1 1/16	Sept. '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*8	*8	*8	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*50	*50	*50	Dec. '20,	0.15
Chief Consol.	Boston Curb	5⅛	5¼	5⅛	Aug. '22, Q	0.10
Columbus Rexall	Salt Lake	*25	*24	*25	Aug. '22,	0.03
Consol. M. & S.	Montreal	27	27	27	Oct. '20, Q	0.62½
Eagle & Blue Bell	Boston Curb	†*5	†*3	*3½	Apr. '21, K	0.05
Electric Point	Spokane	*5	*4	*5	May '20, SA	0.03
Federal M. & S.	New York	†16	†12½	15	Jan. '09,	1.50
Federal M. & S. pfd.	New York	60	58¼	58⅛	Sept. '22, Q	1.25
Florence Silver	Spokane	*36	*35	*36	Apr. '19,	0.01½
Grand Central	Salt Lake	†*65	†*60	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	7⅜	7⅛	7⅜	Sept. '22, Q	0.15
Iron Blossom Con.	N. Y. Curb	*27	*27	*27	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	†4.50	†4.10	3.95	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*16	*14	*15	June '21, I	0.02
Prince Consol.	Salt Lake	*12	*9½	*12	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*4	*3½	*3½	Feb '19,	0.01
Stewart Mines	N. Y. Curb	*7	*7	*7	Dec. '15,	0.05
Tamarack-Custer	Spokane	3.25	3.20	3.20	Jan. '21, K	0.04
Tintic Standard	Salt Lake	3.40	2.85	3.15	Sept. '22, K	0.05
Utah Apex	Boston	2⅜	1⅛	1⅛	Nov. '20, K	0.25
IRON						
Bethlehem Steel "B"	New York	77⅛	74½	77½	Oct. '22	1.2
Char. Iron, pfd	Detr it	2½	2½	2½		
Colorado Fuel & Iron	New York	34⅛	32	32	May '21	0.75
Col. Fuel & Iron, pfd.	New York	105	105	105	Aug. '22	2.00
Gt. North'n Iron Ore	New York	40⅛	38½	39	Nov. '20	1.50
Inland Steel	N. Y. Curb			48½	Sept. '22	1.00
Mesabi Iron	N. Y. Curb			10⅞		
Replogle Steel	New York	35½	33	34½		
Republic I. & Steel	New York	61½	57⅛	60⅜	May '21	1.50
Rep. Iron & St., pfd	New York	90	86⅝	90	Jan. '22	1.75
Sloss-Sheffield S. & I.	New York	51⅜	49⅝	50½	Feb. '21	1.50
U. S. Steel	New York	109⅞	105⅝	109⅝	Sept. '22	1.25
U. S. Steel, pfd.	New York	122⅜	121⅛	122	Aug. '22	1.75
Virginia I. C. & C.	New York	55⅛	54	55	Jan. '22	1.50
Virginia I.C.&C.,pfd.	New York	81	81	81	July '22	2.50
VANADIUM						
Vanadium Corp.	New York	47⅜	44⅛	46⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	69	69	69	July '22, Q	1.50
Asbestos Corp. pfd.	Montreal			85	July '22, Q	1.75
SULPHUR						
Freeport Texas	New York	27⅛	22	27	Nov. '19, Q	1.00
Texas Gulf	New York	64	59	64	Sept. '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Metal	New York	49⅜	48⅛	48⅜	Sept. '22,	0.75
Amer. Metal pfd.	New York	112	111	112	Sept '22, Q	1.75
Amer. Sm. & Ref.	New York	62⅜	60⅝	61	Mar '21, Q	1.00
Amer. Sm.& Ref. pfd	New York	100⅛	99⅝	100	Sept. '22 Q	1.75
Am. Sm. Sec. pfd. A.	New York	97½	97⅛	97⅛	Oct. '22, Q	1.50
U. S. Sm. R. & M.	New York	43⅝	41⅛	43	Jan. '21, Q	0.50
U.S. Sm.R.& M. pfd.	New York	47	46⅜	46⅜	Oct. '22 Q.	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles. Chamber of Mines and Oil; Colorado Springs, The Financial Press, N. Y.

NEW MACHINERY AND INVENTIONS

Mine Machinery Exhibits Draw Crowds in Cleveland

Coal and Metal Mining Equipment Well Represented at American Mining Congress Convention

ALTHOUGH coal mining was the predominant note of the exhibits shown at the Auditorium, Cleveland, Ohio, in connection with the American Mining Congress convention during the week of Oct. 9, there was much to interest the metal-mining man, and reports on all sides indicate that the show was a success. If any criticism is to be made, it might be said that the absence of milling and metallurgical machinery was markedly noticeable, for there were few exhibits outside of the strictly mining field. Two floors were completely given over to the exhibits, which numbered about 150. The machinery floor contained most of the "operating" exhibits, and at all times when the exposition was open to the public there was ample evidence that machine drills and other underground equipment furnish a great deal of ear-deafening activity. The arena floor, containing the remainder of the exhibits, was, for the most part, respectably quiet.

A list of the exhibitors, together with short descriptions of their products, follows. In addition, there were a number of others, but these were devoted particularly to coal mining.

Lake Superior Loader Co., Duluth, Minn., demonstrated the new Model 12 Shuveloder. This is the first announcement of the new machine, in the manufacture of which have been incorporated the suggestions of customers and those of the company as the result of ten years experience in mechanical shoveling.

The rock-drill department of the **General Electric Co., Schenectady, N. Y.,** showed an electric rock drill with a boom mounting, and demonstrations of the machine were made against a limestone block. This type of drill has been successfully used in several of the Lake Superior copper mines. The same company also showed a Type L. M. E.-T 6, 6-ton, 250 v., electric breaking, cable-reel-gathering locomotive, and also an automatic reclosing circuit breaker.

General Motors Truck Co., Pontiac, Mich., exhibited a 3½-ton motor truck provided with a 3-yd. Woods underbody hoist and body.

Westinghouse Electric & Manufacturing Co., Cleveland, Ohio, showed a 150-kw. motor generator set for mine service connected to an automatic switchboard. The Baldwin Locomotive Works showed a 6-ton, Type Y R 2, trolley gathering locomotive.

Swedish Charcoal Steel Producers, Inc., New York, N. Y., exhibited SKF Hofers drill and tool steel, ball-bearing and crusher balls. It is of interest to note, in connection with the Hofers drill steel, that it is being used exclusively on the Hetch Hetchy project in California.

American Blower Co., Detroit, Mich., showed a No. 2 Troy "Sirocco" centrifugal blower and a 60-in. "Ventura" disk fan. Samples of Ventube and Flexpipe flexible piping were shown in connection with this exhibit.

Christman Drilling Co., Massillon, Ohio, showed a small model of a prospecting drill for use in oil well drilling.

Stearns Conveyor Co., Cleveland, Ohio, exhibited Phillips patented conveyor pulleys.

United Filters Corporation, Hazelton, Pa., exhibited a 6-ft. diameter, three-disk American continuous filter, which is used in the dewatering of coal sludge, metallurgical concentrates, slimes and materials of a like nature.

Hyatt Roller Bearing Co., New York, N. Y., showed a large bearing in operation as well as several smaller bearings suitable for use on metal and coal mine cars.

Link Belt Co., Chicago, Ill., showed a number of photographs depicting the several applications of chains for driving purposes.

Fate-Root-Heath Co., Plymouth, Ohio, had two Plymouth gasoline locomotives, of 4-ton and 7-ton capacity on exhibition.

Myers-Whaley Co., Knoxville, Tenn., showed a number of illuminated illustrations showing the application of its loader in coal and metal mines.

In addition to a large showing of welding apparatus, Linde oxygen tanks and similar equipment, the **Oxweld Acetylene Co., Chicago, Ill.,** gave practical demonstrations of oxy-acetylene welding behind a smoked-glass partition.

Among the interesting tests which were made by some of the exhibitors to demonstrate the excellence of their products, one which created considerable favorable comment was that of the **Wood Shovel & Tool Co., Piqua, Ohio.** A testing machine, having a capacity of 14 r.p.m. and arranged so that the shovels are submitted to abrasive wear by being pushed through fragments of red granite, was demonstrated for interested onlookers. In addition, this company showed a complete line of "Mo-lyb-de-num" shovels for different purposes.

Buckeye Blower Co., Columbus, Ohio, showed a 48-in. disk blower mine fan in operation. This machine was direct connected to a self-starting 7½-hp. motor with remote control.

Conneaut Shovel Co., Conneaut, Ohio, showed a full line of shovels for all industries.

Pennsylvania Crusher Co., Philadelphia, Pa., exhibited one of its "Pennsylvania" single-roll crushers. This company also manufactures "Bradford" breakers and hammer crushers.

The feature of the exhibit of the **Wellman-Seaver-Morgan Co., Cleveland, Ohio,** was a 28-hp. industrial engine for application on cranes, power shovels, locomotives, pumps, and similar machinery. A model of a gravity mine car tipple and several photographs of mine hoists were shown.

Morse Chain Co., Ithaca, N. Y., exhibited an operating model of a chain drive. A clever arrangement enabled onlookers to get a slow motion view showing actual operation of the Morse Rocker Joint.

Duro Metal Products Co., Chicago, Ill., demonstrated three types of the Lily Hoist Controller. This controller is an electrical and mechanical safety device for installation on hoists used at mines, geared in ratio with the hoisting drum, to prevent accident from overspeeding, overwinding, or for various failures for which the engineer could be held responsible, as well as a number of possible accidents from causes beyond his control.

Standard Oil Co., Cleveland, Ohio, had an exhibit of Polarine oils and greases.

A gear drive, mining type gasoline locomotive; a worm-gear storage-battery locomotive, and a Whitcomb "Permissible" controller were included in the exhibit of the **Geo. D. Whitcomb Co., Rochelle, Ill.**

Flexible Steel Belt Lacing Co., Chicago, Ill., showed a small operating belt drive in addition to the company's line of steel belt lacing.

Ludlow Saylor Wire Co., St. Louis, Mo., exhibited samples of double-crimped wire cloth and mining screen.

A model of a "Canton" automatic mine door was the feature of the exhibit of the **American Mine Door Co., Canton, Ohio.** This door consists of two pannels which are actuated by spring levers moved by pressure on an auxiliary track rail.

The Bristol Company, Waterbury, Conn., emphasized in its exhibit the Bristol line of hardware, belt lacing, and safety set screws. Recording gages for ventilating fans were also shown.

Blasting fuses and machines and explosives were shown in the exhibit of **E. I. Du Pont de Nemours & Co., Wilmington, Del.**

Hazard Mfg. Co., Hazelton, Pa., showed samples of wire rope and covered cables.

A "Longlife" conveyor belt, 360 ft. long, 30-in. wide, 7-ply, coiled and ready for shipment to the Katanza mines in South Africa attracted the greatest attention at the booth of the **B. F. Good-**

rich Rubber Co. Steam hose, air-drill hose, "Hipress boots," and "Commander" transmission belts were also shown.

John A. Roebling's Sons Co., Trenton, N. J., exhibited samples of elevator rope, hoisting rope, wire, rope fittings, safety slings, and insulated wire.

Hercules Powder Co., Wilmington, Del., showed samples of steam distilled pine oils, crude steam distilled oil, and crude pine reagents for flotation purposes. A number of the publications of the company were also in evidence.

In addition to photographs showing underground installations of mine locomotives, **The Goodman Mfg. Co., Chicago, Ill.,** exhibited a small model of the Goodman equalizer bar used on the company's two-motor locomotive for keeping the machine on the track and for securing full effective draw-bar pull. Goodman improved coal cutter teeth were also shown.

Simplex Wire & Cable Co., Boston, Mass., showed samples of "Tirex" mining cable and portable cords of different sizes.

Brown Hoist Machinery Co., Cleveland, Ohio, exhibited for the first time the company's new line of belt and chain conveyors.

American Steel & Wire Co., Chicago, Ill., showed hoisting and portable cables for mining use.

W. S. Tyler Co., Cleveland, Ohio, showed two operating "Hum-mer" screens, as well as copper and other metal screening.

Cleveland Rock Drill Co., Cleveland, Ohio, exhibited a number of independently rotated drills. Four types of mounted drifters, three types of stopers, four types of rotaters and one auger drill were shown. In addition, a line of couplings, valves and hose, and forgings made in the company's own shops were also exhibited.

United States Bureau of Mines, Washington, D. C., included in its booth, first aid manikins, showing the various applications of bandages; Paul and Gibbs rescue apparatuses; Mc C A A breathing apparatus, one-half and two-hour machines; and Burrel all-service gas masks.

Atlas Car Mfg. Co., Cleveland, Ohio showed a working model of the Atlas drive unit as used in the locomotives made by this company. A 2-ton gasolene locomotive and a 2-ton storage battery locomotive, used in metal mines, were exhibited; also a 5½-ton low type storage battery locomotive for use in coal mines.

Timkin Roller Bearing Co., Canton, Ohio, showed several applications of bearings to car wheels. This particular exhibit was not the only example of Timkin bearings in evidence, for many of the exhibitors of transportation machinery stated that the bearings of this company were used on their type of machines.

Ohio Brass Co., Mansfield, Ohio, showed a complete line of trolley supports, rail bonds, and insulators for use in mine transportation.

"Exide Ironclad" batteries for motive power service were shown by the **Electric Storage Battery Co., Philadelphia, Pa.**

Photographs showing coal mine locomotives and "Straitflo" ventilating fans were exhibited by **The Jeffrey Mfg. Co., Columbus, Ohio.**

Mancha Storage Battery Locomotive Co., St. Louis, Mo., showed a 5-ton type "Mancha's Electric Mule," used in coal or metal mines. This locomotive is equipped with a new tilting top and drip pan which permits the battery to be washed with a hose. There is also a patented fuse box consisting of 3 fuses which provides replacement and saves time in the event of the blowing of any of the fuses. Photographs of other types of locomotives made by the company were shown.

Photographs of machinery installations in coal and metal mines constituted the exhibit of the **Allis-Chalmers Mfg. Co., Milwaukee, Wis.**

Edison Storage Battery Co., Orange, N. J., showed photographs of storage-battery cells for industrial purposes.

An attractive model showing the application of an aërial tramway was demonstrated by **A. Leschen & Sons Rope Co., St. Louis, Mo.,** who also showed several samples of cable.

Austin Powder Co., Cleveland, Ohio, displaying its line of blasting powder and appurtenances.

Oil shale was the predominent note of the exhibit of the **Colorado School of Mines.** A laboratory plant for the distillation of oil shale was in operation, and a number of photographs and samples of shale were shown.

Commerce Reports, that informative and well prepared publication of the **U. S. Department of Commerce,** was strongly in evidence at the booth occupied by that government bureau.

New York Belting & Packing Co., New York, N. Y., showed a 436-ft. coiled, 16-in., 6-ply, special transmission belt, and a 435-ft. coiled, 24-in., 6-ply conveyor belt, in addition to air and tool hose, and sheet and spiral packing.

A standard gathering storage-battery locomotive, W. L. type, with a 7,000-lb chassis, was the feature of the **Ironton Engine Co., Ironton, Ohio,** exhibit.

Hadfield-Penfield Steel Co., Bucyrus, Ohio, made the initial announcement of the company's special steel wheels.

Rome Wire Co., Rome, N. Y., exhibited samples of covered cords and cables for mining use.

Safety signs, first-aid cabinets, safety lamps, rescue apparatus, and material of a like nature were attractively displayed by the **Mine Safety Appliance Co., Pittsburgh, Pa.**

CONSTRUCTION NEWS

Silver State Chemical Co. May Enlarge Plant at Winnemucca, Nev.

It is reported that the Silver State Chemical Co. proposes an addition to its plant in Winnemucca, Nev. Negotiations with an English syndicate have been in progress for some time.

American Zinc, Lead & Smelting Co. Will Build Mill for Silver Dike Mine in Montana

The General Engineering Co., of Salt Lake City, has been retained by the Silver Dike Mining Co. for the design of the 500-ton mill to be built at Neihart, Mont. The construction work will be done by contract, and the mill is expected to go into operation early in the new year. The Silver Dike property is controlled by the American Zinc, Lead & Smelting Co.

Steel Stocking Trestle Will Be Erected at Athens Mine, on Marquette Range

The Worden-Allen Co. has been awarded a contract for the erection of a steel stocking trestle at the Athens mine of the Cleveland-Cliffs Iron Co. at Negaunee, Mich. This will be over 1,200 ft. in length, and similar to the one at the Negaunee mine, although of heavier construction.

New Unit for McKinney Steel Co. Nashwauk Concentrator

The McKinney Steel Co. has started excavating for another unit to its iron-ore concentrator at Nashwauk, Minn. The unit to be built will be of the same size as the present one, which consists of a revolving screen, two log, and four turbo washers, and tables. It has not been definately decided whether to put in another table floor or increase the capacity of the tables in the present unit by a second deck.

Construction of New Kimberly Concentrator Progresses Rapidly

The erection of the new concentrator of the Consolidated Mining & Smelting Co. at Kimberly, B. C., is progressing rapidly. The plant is designed to treat 3,000 tons per day and will reduce the ores of the Sullivan mine, owned by the company. The first unit of 1,500 tons' capacity is expected to be ready for operation in the spring. At present the ores from the mine are treated in the company's concentrator at Trail, which was formerly used in connection with the mines at Rossland, B. C. It is rumored that as soon as the new plant is in operation the mines at Rossland will be reopened.